

DEPARTMENT OF VETERANS AFFAIRS
RENOVATION
of
DERMATOLOGY CLINIC
for
PRIMARY CARE
at
Michael E. DeBakey VA Medical Center
Houston, Texas

Project Number 580-13-405

PROJECT MANUAL

Construction Documents Submission

Not for Regulatory Approval, Permitting, or Construction

April 11, 2014

ATRIAX PLLC

Prime Contractor

Architecture and Landscape Architecture: GLMV Architecture, Inc.

Mechanical, Plumbing and Electrical Engineering: Garner Fritsche Engineering, Inc.

DEPARTMENT OF VETERANS AFFAIRS
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See Cover for Issuance Date. Specifications Divisions and Sections bound herein are listed below under the name of the Designer of Record responsible for their preparation, under whose seal and/or authority each document so listed is issued for the purpose(s) stated above. Seals and signatures do not apply to documents not listed below, nor to documents prepared by the Owner or others, including (except as otherwise indicated) Sections in Division 00 Procurement and Contracting Requirements and Division 01 General Requirements, Geotechnical Reports, etc.

Architect of Record:

Steven E. Woods, AIA

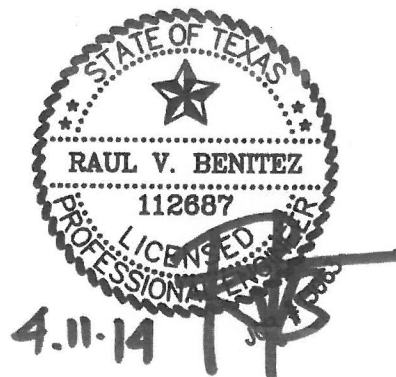
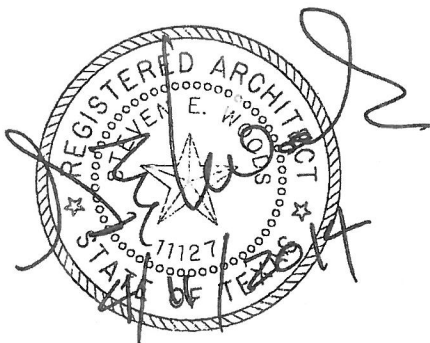
GLMV Architecture, Inc.

Divisions 02, 04, 05, 06, 07, 08, 09, 10, 11, 12,
and Sections 01 33 23, 01 42 19, 01 57 19,
01 58 16 & 01 74 19

Engineer of Record, Mechanical, Electrical & Plumbing:

Garner Fritsche Engineering, Inc.

Divisions 22, 23, and 26



Department of Veterans Affairs

Renovation of Dermatology Clinic for Primary Care at

Michael E. DeBakey VA Medical Center, Houston, Texas
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**Asterisks denote documents prepared or furnished by the
Government. Government-prepared documents govern all Work.*

*Note that all applicable documents are not necessarily included herein; a document's presence
in, or absence from, the Project Manual is not evidence of its applicability or
inapplicability.*

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SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Department of Veterans Affairs, Renovations of B100 for Dermatology Clinic for Primary Care at Michael E. DeBakey VA Medical Center, Houston, Texas, as required by Drawings and Specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Contracting Officer's Representative (COR).
- C. Offices of Atriax Group, as Architect-Engineers, will render certain technical Services during construction. Such Services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by COR or his duly authorized representative.
- D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the COR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than 3 work days unless otherwise designated by the COR.
- E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by Project and employer, and restricted from unauthorized access.
- F. Prior to commencing work, general contractor shall provide proof that a OSHA designated "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- G. Training:
 - 1. All employees of general contractor or subcontractors shall have the 10-hour or 30-hour OSHA Construction Safety course and other relevant competency training, as determined by COR acting as the Construction

Safety Officer with input from the facility Construction Safety Committee.

2. Submit training records of all such employees for approval before the start of work.

H. VHA Directive 2011-36, Safety and Health during Construction, dated 9/22/2011 in its entirety is made a part of this Section. Contractor shall submit valid negative tuberculin screening test documentation, for each worker, dated within 90 days prior to assignment to the work site.

1.2 STATEMENT OF BID ITEM(S)

A. ITEM I, RENOVATION: Work includes general construction, alterations, mechanical and electrical work, utility systems, necessary removal of existing structures and construction and certain other items.

B. DEDUCT OPTION 1:

1. Base Bid: The Base Bid includes all the Work as indicated on the Drawings and the Specifications.

2. Deduct Option 1:

- a. The proposed deduct amount for Deduct Option 1, if accepted, will be deducted from the proposed Base Bid amount, in order to establish the Contract Award Amount.

- b. Deduct Option 1 includes alternate work described specifically on the Drawings, applied as indicated on the Bid Form, and generally described as follows:

- 1) Existing Exam Rooms 1A-512, 1A-514, 1A-516, 1A-520, 1A-522 and 1A-524, in lieu of the Base Bid Work, are to remain "as is," including the existing ceiling, light fixtures and HVAC grilles, with the following exceptions:

- a) The walls are to be patched and repainted as needed to match existing.

- b) Provide with new doors and hardware, and paint existing frames as scheduled in the Base Bid Scope of Work.

- c) Fixture lamps are to be replaced. Fixture lenses and HVAC grilles are to be cleaned.
- 2) Door C507, in lieu of the Base Bid Work, is to be revised to a 48- by 96-inch solid-core wood door with a painted hollow metal frame, incorporating a sidelight. Total opening width, with sidelight, is to be the same as the scheduled double doors. Door and frame are to incorporate the following:
 - a) Door hardware shall include a door closer on magnetic hold-opens connected to the fire alarm system in lieu of the scheduled door operator. Exit device shall be non-electric.
 - b) Hollow metal frame at sidelight shall have horizontal dividers, height(s) to be determined. Sidelight shall be a 3Form panel. Actual selection shall be determined by Owner, but shall be similar to 3Form panel scheduled as part of the reception millwork.
- 3) Provide fluorescent lamps in lieu of the LED lamps scheduled for ceiling light fixtures under the Base Bid.
- 4) In lieu of the Base Bid Scope of Work, all existing HVAC diffusers may be reused at the Contractor's discretion if of the right type, size, undamaged, and of the correct configuration. Reused diffusers shall be cleaned prior to reuse.
- 5) All Work not revised under this Deduct Option 1 is to be executed as scheduled on the Drawings under the Base Bid Scope of Work.

C. DEDUCT OPTION 2:

- 1. Base Bid: The Base Bid includes all the Work as indicated on the Drawings and the Specifications.
- 2. Deduct Option 2:
 - a. Deduct Option 2, if accepted, will be considered, or awarded, only in conjunction with Deduct Option 1. Deduct Option 2 will not be awarded by itself. The proposed amount for Deduct Option 1 will

be added to the proposed amount for Deduct Option 2 and the sum of the two Options will be deducted from the proposed Base Bid amount, in order to establish the Contract Award Amount.

- b. Deduct Option 2 includes alternate work described specifically on the Drawings, applied as indicated on the Bid Form, and generally described as follows:
- 1) In lieu of the Base Bid Scope of Work, all existing lay-in suspended ceilings located west of double Door C505, both in the hallways and other adjacent rooms, not subject to partition relocation are to remain "as is," including light fixtures and HVAC grilles, with the following exceptions:
 - a) Fixture lamps are to be replaced. Fixture lenses and HVAC grilles are to be cleaned.
 - 2) In lieu of the Base Bid Scope of Work, all scheduled lay-in ceiling systems not included in Item 1) of the above-listed deduct are to be new, to match the existing remaining ceiling systems.
 - 3) In lieu of the Base Bid Work, existing handrails shall be worked on as follows:
 - a) West of double Door C505, all existing handrails are to remain and/or be reused and reconfigured where work is scheduled affecting the existing handrails. The finish cover is to remain.
 - b) Handrails east of double Door C505 are to be removed, and parts may be utilized as needed west of double Door C505. If additional handrail parts or components are required, match the existing system and finish.
 - c) All scheduled handrails east of double Door C505 are to be new, with finish selections per the Base Bid Scope of Work Finish Schedule.
 - 4) In lieu of the Base Bid Scope of Work, relaminate the existing doors to match the new door finish selection scheduled. Existing doors and frames removed as part of construction may

be relaminated and/or repainted, as applicable, and reused, if of proper configuration and undamaged.

- 5) In lieu of the Base Bid Scope of Work, existing door hardware is to be reused if of proper configuration and good working order as scheduled for new hardware. Provide new door hardware where existing hardware is not available within the limits of the Project.
- 6) All Work not revised under this Deduct Option 2 is to be executed as scheduled on the Drawings under the Base Bid Scope of Work.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. AFTER AWARD OF CONTRACT, the Contractor will be furnished electronic files of the Contract Documents on CD-ROM or DVD, as applicable, for Contractor's use in executing the Contract.
- B. Additional sets of Drawings may be made by the Contractor, as needed or required, at Contractor's expense.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

- A. Security Plan:
 1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the Project.
 2. The General Contractor is responsible for assuring that all subcontractors working on the Project and their employees also comply with these regulations.
- B. Security Procedures:
 1. General Contractor's employees shall not enter the Project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the Project site.
 2. For working outside the "regular hours" as defined in the Contract, The General Contractor shall give 3 days' notice to the COR so that security arrangements can be provided for the employees. This notice

is separate from any notices required for utility shutdown described later in this Section.

3. No photography of VA premises is allowed without written permission of the COR.
4. VA reserves the right to close down or shut down the Project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the COR.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the COR for the purpose of security inspections of every area of Project including tool boxes and parked machines and take any emergency action.
2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

D. Document Control:

1. Before starting any work, the General Contractor/subcontractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information."
2. The General Contractor is responsible for safekeeping of all Drawings, Project Manual, and other Project information. This information shall be shared only with those with a specific need to accomplish the Project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified." Secure such information in separate containers and limit the access to only those who will need it for the Project. Return the information to the COR upon request.
4. These security documents shall not be removed or transmitted from the Project site without the written approval of COR.

5. All paper waste or electronic media such as CDs and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify COR and Site Security Officer immediately when there is a loss or compromise of "sensitive information."
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
 - a. Security, access and maintenance of all Project Drawings, both scanned and electronic, shall be performed and tracked through the EDMS system.
 - b. "Sensitive information" including Drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

E. Motor Vehicle Restrictions:

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. Separate permits shall be issued for General Contractor and its employees for parking in designated areas only.

1.5 FIRE SAFETY

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM):

E84-2009.....Surface Burning Characteristics of Building
Materials

2. National Fire Protection Association (NFPA):

10-2010.....Standard for Portable Fire Extinguishers

30-2008.....Flammable and Combustible Liquids Code

51B-2009.....Standard for Fire Prevention During Welding,
Cutting and Other Hot Work

70-2011.....National Electrical Code

101-2012.....Life Safety Code

241-2009.....Standard for Safeguarding Construction,
Alteration, and Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

29 CFR 1926.....Safety and Health Regulations for Construction

4. VHA Directive 2005-007

B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing Project-specific fire safety measures, including periodic status reports, and submit to COR for review for compliance with VHA Directive 2005-007, NFPA 101 and NFPA 241. Prior to beginning work, all employees of the Contractor and/or any subcontractors shall undergo a safety briefing provided by the General Contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Provide documentation to the COR that all construction workers have undergone Contractor's safety briefing.

C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.

D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 20 feet exposing overall length, separate by 10 feet.

E. Temporary Construction Partitions:

1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or treated plywood (flame

- spread rating of 25 or less in accordance with ASTM E84) on both sides of fire-retardant-treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾-hour fire-/smoke-rated doors with self-closing devices.
2. Install 1-hour fire-rated temporary construction partitions as shown on Drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
 3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COR.
- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR.
- I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article OPERATIONS AND STORAGE AREAS,

and coordinate with COR. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the Medical Center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the COR.

- M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR.
- N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR. Obtain permits from facility Safety Officer at least 24 hours in advance. Designate Contractor's responsible Project-site fire prevention program manager to permit hot work.
- O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR.
- P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- R. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- S. If required, submit documentation to the COR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the COR. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the COR and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the COR, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the COR, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the COR. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be as determined by the COR.
- E. Working space and space available for storing materials shall be as shown on the Drawings.
- F. Workmen are subject to rules of Michael E. DeBakey Medical Center applicable to their conduct.
- G. Execute work so as to interfere as little as possible with normal functioning of Michael E. DeBakey Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.
 - 1. Do not store materials and equipment in other than assigned areas.
 - 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of

- Veterans Affairs in quantities sufficient for not more than 2 work days. Provide unobstructed access to Michael E. DeBakey Medical Center areas required to remain in operation.
3. Where access by Michael E. DeBakey Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.
- H. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR. All such actions shall be coordinated with the Utility Company involved.
- I. Phasing: To insure such executions, Contractor shall furnish the COR with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR 2 weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to insure accomplishment of this work in successive phases mutually agreeable to COR and Contractor.
- J. Building No. B100 will be occupied during performance of work; but immediate areas of alterations will be vacated.
1. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Center's operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.

2. Immediate areas of alterations not mentioned in preceding subparagraph 1 will be temporarily vacated while alterations are performed.

K. When a Project area is turned over to Contractor, Contractor shall accept entire responsibility therefore.

1. Contractor shall maintain a minimum temperature of 40 degrees F at all times, except as otherwise specified.
2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Department of Veterans Affairs, whichever will be required to respond to an alarm from Contractor's employee or watchman.

L. Utilities Services: Maintain existing utility services for Michael E. DeBakey Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director's prior knowledge and written approval. Refer to Specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS; 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS; and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.
2. Contractor shall submit a request to interrupt any such services to COR, in writing, 48 hours in advance of proposed interruption.

- Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Michael E. DeBakey Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
 4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
 5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
- M. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- N. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least 1 lane must be open to traffic at all times.
 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.
- O. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR and a representative of VA Supply Service, of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by all three, to the COR. This report shall list by rooms and spaces:
1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of building.
 2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by Drawings to be either reused or relocated, or both.
 3. Shall note any discrepancies between Drawings and existing conditions at site.
 4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.
- B. Any items required by Drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR and/or Supply Representative, to be in such condition that their use is impossible or impractical, shall be furnished by the VA or replaced by Contractor with new items in accordance with Specifications which will be furnished by Government. Provided the Contract work is changed by reason of this subparagraph B, the Contract will be modified accordingly, under provisions of clauses entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:

1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this Contract.

D. Protection: Provide the following protective measures:

1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
3. Protection of interior of existing structures at all times from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.8 INFECTION PREVENTION MEASURES

- A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the Contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group as specified here. Prior to start of work, prepare a plan detailing Project-specific dust protection measures, including periodic status reports, and submit to COR and Facility ICRA team for review for compliance with Contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the Medical Center.

C. Medical Center Infection Control personnel shall monitor for airborne disease (e.g., aspergillosis) as appropriate during construction. A baseline of conditions may be established by the Medical Center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:

1. The COR and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the Contractor shall implement corrective measures to restore proper pressure differentials as needed.
2. In case of any problem, the Medical Center, along with assistance from the Contractor, shall conduct an environmental assessment to find and eliminate the source.

D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.

1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by COR. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
2. Do not perform dust producing tasks within occupied areas without the approval of the COR. For construction in any areas that will remain jointly occupied by the Medical Center and Contractor's workers, the Contractor shall:
 - a. Provide dust-proof, 1-hour fire-rated temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed and made presentable on hospital occupied side. Install a self-closing rated door in a metal frame, commensurate with the partition, to allow worker access. Maintain negative air at all times. A fire-retardant polystyrene, 6-mil thick or greater, plastic barrier meeting local

fire codes may be used where dust control is the only hazard, and an agreement is reached with the COR and Medical Center.

- b. High Efficiency Particulate Accumulator (HEPA) filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the Medical Center through intake vents or building openings. Install HEPA filter vacuum system rated at 95 percent capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the Medical Center.
- c. Adhesive walk-off/carpet walk-off mats, minimum 24 by 36 inches, shall be used at all interior transitions from the construction area to occupied Medical Center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
- d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
- e. The Contractor shall not haul debris through patient-care areas without prior approval of the COR and the Medical Center. When, approved, debris shall be hauled in enclosed dust-proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc., transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe-down.
- f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for

investigation beyond sealed areas shall be sealed immediately when unattended.

g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.

h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

E. Final Cleanup:

1. Upon completion of Project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or freestanding), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

1.9 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:

1. Reserved items which are to remain property of the Government are identified by attached tags as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to reinstallation and reuse. Store such items where directed by COR.
2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this Contract shall remain

the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by Drawings and Specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- 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 COR.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and 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 COR may have the necessary work performed and charge the cost to the Contractor.

1.11 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

- B. Upon completion of Contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on Drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on Drawings or locations of which are unknown will be covered by adjustment to Contract time and price in accordance with clauses entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.12 PHYSICAL DATA

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
 - 1. The indications of physical conditions on the Drawings and in the specifications are the result of site investigations.

1.13 LAYOUT OF WORK

- A. The Contractor shall lay out the interior renovation work indicated on the Drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the COR. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the COR until authorized to remove them. If such marks are destroyed by the Contractor or through

Contractor's negligence before their removal is authorized, the COR may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

1.14 AS-BUILT DRAWINGS

- A. The Contractor shall maintain 2 full-size sets of As-built Drawings which will be kept current during construction of the Project, to include all Contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the Contract Drawings. To insure compliance, As-built Drawings shall be made available for the COR's review as often as requested.
- C. Contractor shall deliver 2 approved completed sets of As-built Drawings to the COR within 15 calendar days after each completed phase and after the acceptance of the Project by the COR.
- D. Paragraphs A, B, and C shall also apply to all shop drawings.

1.15 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR, such temporary roads which are necessary in the performance of Contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

1.16 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
 - 1. Permission to use each unit or system must be given by COR. If the equipment is not installed and maintained in accordance with the following provisions, the COR will withdraw permission for use of the equipment.
 - a. Electrical installations used by the equipment shall be completed in accordance with the Drawings and Specifications to prevent damage to the equipment and the electrical systems, i.e., transformers, relays, circuit breakers, fuses, conductors, motor

controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.

- b. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 - c. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
 - d. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
 - e. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained, and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

1.17 TEMPORARY USE OF EXISTING ELEVATORS

- A. Use of existing elevators for handling building materials and Contractor's personnel will be permitted subject to following provisions:
 - 1. Contractor makes all arrangements with the COR for use of elevators. The COR will ascertain that elevators are in proper condition.

Contractor may use designated elevators as assigned by COR in Building No. 100 for special nonrecurring time intervals when permission is granted. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.

2. Contractor covers and provides maximum protection of following elevator components:
 - a. Entrance jambs, heads soffits and threshold plates.
 - b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
 - c. Finish flooring.

1.18 TEMPORARY TOILETS

- A. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.19 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the Contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the COR, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

- C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.
- D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:
 - 1. Obtain heat by connecting to Medical Center heating distribution system.
 - a. Steam is available at no cost to Contractor.
- E. Electricity (for Construction and Testing): Furnish all temporary electric services.
 - 1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- F. Water (for Construction and Testing): Furnish temporary water service.
 - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
 - 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR's discretion) of use of water from Medical Center's system.

1.20 NEW TELEPHONE EQUIPMENT

- A. The Contractor shall coordinate with the work of installation of telephone equipment by others. This work shall be completed before the building is turned over to VA.

1.21 TESTS

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various Sections of Specifications in presence of an authorized representative of the COR. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.22 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating Manuals (hard copies and electronic) and verbal instructions when required by the various Sections of the Specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals and 1 compact disc (4 hard copies and 1 electronic copy each) for each separate piece of equipment

shall be delivered to the COR coincidental with the delivery of the equipment to the jobsite. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the jobsite. These requirements are more specifically detailed in the various technical Sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.23 GOVERNMENT-FURNISHED PROPERTY

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on the Drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.
- C. Storage space for equipment will be provided by the Government and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Medical Center.
- D. Notify COR in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government.
Arrangements will then be made by the Government for delivery of equipment.
 - 1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government.
At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
 - 2. Contractor thereafter is responsible for such equipment until such time as acceptance of Contract Work is made by the Government.
- E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government-furnished equipment item and the utility stub-up shall be furnished and installed by the Contractor at no additional cost to the Government.
- F. Completely assemble and install the Government-furnished equipment in place ready for proper operation in accordance with Specifications and Drawings.

- G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.24 RELOCATED EQUIPMENT AND ITEMS

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the COR.
- C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines."
- D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- E. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

1.25 HISTORIC PRESERVATION

- A. Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the COR verbally, and then with a written follow up.

1.26 VA TRIRIGA CPMS

- A. VA contractors, selected by award to perform work, are required to get access to the VA TRIRIGA CPMS. The TRIRIGA CPMS is the management and collaborative environment that the VA uses for all Major, Minor and Non-Recurring Maintenance (NRM) projects within the Office of Construction &

Facilities Management (CFM), Veterans Health Administration (VHA),
National Cemetery Administration (NCA), and the Veterans Benefits
Administration (VBA).

1. The Contractor is solely responsible for acquiring access to the VA TRIRIGA CPMS.
 2. To gain access to the VA TRIRIGA CPMS the Contractor is encouraged to follow the licensing process outline as specified below.
- B. Requirement: TRIRIGA is the management and collaborative environment that VA uses for all construction projects. VA requires its contractors to procure TRIRIGA access as part of the cost of performance for a VA construction related contract.
- C. Access Request and Payment can be made through the following URL:
- <https://valicensing.oncfi.com/>
- Inquiries or to request additional services, contact the following:
- Craig Alsheimer, Federal Account Manager
- Computerized Facility Integrations, LLC
- 18000 West Nine Mile Road, Suite 700
- Southfield, MI 48075
- Email: calsheimer@gocfi.com
- Phone: 248-557-4234 Extension 6010; 410-292-7006
- D. Process:
1. Once the Contractor has been notified by VA of the award and a unique Contract number, the Contractor can enter a request for access to TRIRIGA at URL <https://valicensing.oncfi.com/>
 2. CFI will process the request for access and payment. CFI will create the USER ID and a password. Security provisions required to align the contractor to the Contract Number will be entered and an email will be generated and submitted to the requestor.

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3. CFI will also provide standard terms and conditions related to the transaction and use agreement.

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SECTION 01 32 16.15
PROJECT SCHEDULES
(SMALL PROJECTS - DESIGN/BID/BUILD)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall develop a critical path method (CPM) plan and schedule demonstrating fulfillment of the Contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this Section and shall utilize the plan for scheduling, coordinating and monitoring work under this Contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional critical path method (CPM) technique shall be utilized to satisfy both time and cost applications.

1.2 CONTRACTOR'S REPRESENTATIVE

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COR).
- B. The Contractor's representative shall have direct Project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this Specification Section.
- C. The Contractor's representative shall have the option of developing the Project Schedule within their organization or to engage the services of an outside consultant. If an outside scheduling consultant is utilized, Section 1.3 of this Specification will apply.

1.3 CONTRACTOR'S CONSULTANT

- A. The Contractor shall submit a qualification proposal to the COR, within 10 days of bid acceptance. The qualification proposal shall include:
1. The name and address of the proposed consultant.
 2. Information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.
 3. A representative sample of prior construction projects, which the proposed consultant has performed complete project scheduling services. These representative samples shall be of similar size and scope.
- B. The COR has the right to approve or disapprove the proposed consultant, and will notify the Contractor of the VA decision within 7 calendar days from receipt of the qualification proposal. In case of disapproval, the

Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The Contractor shall have their scheduling consultant approved prior to submitting any schedule for approval.

1.4 COMPUTER-PRODUCED SCHEDULES

- A. The Contractor shall provide monthly, to the Department of Veterans Affairs (VA), all computer-produced time/cost schedules and reports generated from monthly Project updates. This monthly computer service will include: three copies of up to 5 different reports (inclusive of all pages) available within the user-defined reports of the scheduling software approved by the COR; a hard copy listing of all Project Schedule changes, and associated data, made at the update and an electronic file of this data; and the resulting monthly updated schedule in PDM format. These must be submitted with and substantively support the Contractor's monthly payment request and the signed look ahead report. The COR shall identify the 5 different report formats that the Contractor shall provide.
- B. The Contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also be responsible for the accurate and timely submittal of the updated Project Schedule and all CPM data necessary to produce the computer reports and payment request that is specified.
- C. The VA will report errors in computer-produced reports to the Contractor's representative within 10 calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette(s), when requested by the COR, to correct errors which affect the payment and schedule for the Project.

1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL

- A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the COR's review; 3 blue-line copies of the interim schedule on sheets of paper 30 by 42 inches and an electronic file in the previously approved CPM schedule program. The submittal shall also include 3 copies of a computer-produced activity/event ID schedule showing Project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the Contract, will not

be accepted unless submitted to and approved by the COR. The Contractor shall make a separate written detailed request to the COR identifying these date constraints and secure the COR's written approval before incorporating them into the network diagram. The COR's separate approval of the Project Schedule shall not excuse the Contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete Project. **The final Project Schedule in its original form shall contain no Contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire Contract duration as defined in the Bid Documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for Contract time as a result of Contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

- B. Within 30 calendar days after receipt of the complete Project interim Project Schedule and the complete final Project Schedule, the COR will do one or both of the following:
1. Notify the Contractor concerning his actions, opinions, and objections.
 2. A meeting with the Contractor at or near the jobsite for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit 3 blueline copies of the revised Project Schedule, 3 copies of the revised computer-produced activity/event ID schedule and a revised electronic file as specified by the COR. The revised submission will be reviewed by the COR and, if found to be as previously agreed upon, will be approved.
- E. The approved baseline schedule and the computer-produced schedule(s) generated therefrom shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this Section.

1.6 WORK ACTIVITY/EVENT COST DATA

- A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work

activities/events (including alternates) shall equal the total Contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire Project length. The Contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the COR to assist him in determining approval or disapproval of the cost loading. Negative work activity/event cost data will not be acceptable, except on VA-issued Contract changes.

- B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS).
- C. In accordance with FAR 52.236 - 1 (PERFORMANCE OF WORK BY THE CONTRACTOR) and VAAR 852.236 - 72 (PERFORMANCE OF WORK BY THE CONTRACTOR), the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work.
- D. The Contractor shall cost load work activities/events for all BID ITEMS. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

1.7 PROJECT SCHEDULE REQUIREMENTS

- A. Show on the Project Schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor shall:
 - 1. Show activities/events as:
 - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar preconstruction work.
 - b. COR's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
 - c. Interruption of VA facilities utilities, delivery of Government-furnished equipment, and rough-in drawings, Project phasing and any other Specification requirements.
 - d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.

- e. VA inspection and acceptance activity/event with a minimum duration of 5 workdays at the end of each phase and immediately preceding any VA move activity/event required by the Contract phasing for that phase.
 2. Show not only the activities/events for actual construction work for each trade category of the Project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least 5 trades who are performing major work under this contract.
 3. Break up the work into activities/events of a duration no longer than 20 workdays each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 workdays.
 4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
 5. The schedule shall be generally numbered in such a way to reflect discipline, phase or location of the Work.
- B. The Contractor shall submit the following supporting data in addition to the Project Schedule:
1. The appropriate Project calendar including working days and holidays.
 2. The planned number of shifts per day.
 3. The number of hours per shift.
- Failure of the Contractor to include this data shall delay the review of the submittal until the COR is in receipt of the missing data.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COR. Failure to include any element of work required for the performance of this Contract shall not excuse the Contractor from completing all Work required within any applicable completion date of each phase regardless of the COR's approval of the Project Schedule.
- D. Compact Disk Requirements and CPM Activity/Event Record Specifications:
Submit to the VA an electronic file(s) containing one file of the data

required to produce a schedule, reflecting all the activities/events of the complete Project Schedule being submitted.

1.8 PAYMENT TO THE CONTRACTOR

- A. Monthly, the Contractor shall submit the AIA Application and Certificate for Payment Documents G702 and G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated Project Schedule. Monthly payment requests shall include: a listing of all agreed upon Project Schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.
- B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the Project Schedule.

1.9 PAYMENT AND PROGRESS REPORTING

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the COR and the Contractor. Contractor and their CPM consultant (if applicable) shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the COR 3 workdays in advance of the schedule update meeting. Job progress will be reviewed to verify:
 - 1. Actual start and/or finish dates for updated/completed activities/events.
 - 2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
 - 3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
 - 4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
 - 5. Completion percentage for all completed and partially completed activities/events.
 - 6. Logic and duration revisions required by this Section of the Specifications.

7. Activity/event duration and percent complete shall be updated independently.
- B. After completion of the joint review, the Contractor shall generate an updated computer-produced, calendar-dated schedule and supply the COR with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.
- C. After completing the monthly schedule update, the Contractor's representative or scheduling consultant shall rerun all current period Contract change(s) against the prior approved monthly Project Schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the Contractor and resident engineer for the Contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the COR. After each rerun update, the resulting electronic Project Schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly Project Schedule update requirements and shall be submitted to the resident engineer within 14 calendar days of completing the regular schedule update. **Before inserting the Contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the Contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for Contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.**
- D. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, COR, and all subcontractors needed, as determined by the COR, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of Project Schedule and to identify any necessary actions required to maintain Project Schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain Project Schedule status during the reporting period. This schedule coordination meeting will occur after each monthly Project Schedule update meeting utilizing the resulting

schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the Project Schedule status, when appropriate.

1.10 RESPONSIBILITY FOR COMPLETION

- A. If it becomes apparent from the current revised monthly progress schedule that contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
 - 1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of Work.
 - 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of Work.
 - 3. Reschedule the Work in conformance with the Specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COR for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

1.11 CHANGES TO THE SCHEDULE

- A. Within 30 calendar days after VA acceptance and approval of any updated Project Schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
 - 1. Delay in completion of any activity/event or group of activities/events, which may be involved with Contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the Project beyond the acceptable limits.
 - 2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the Work necessary.
 - 3. The schedule does not represent the actual prosecution and progress of the Project.
 - 4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.
- B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, Contract phase(s) and sub

phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the COR for approval.

- C. COR's approval for the revised Project Schedule and all relevant data is contingent upon compliance with all other paragraphs of this Section and any other previous agreements by the COR.
- D. The cost of revisions to the Project Schedule resulting from Contract changes will be included in the proposal for changes in work as specified in FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental), and will be based on the complexity of the revision or Contract change, man-hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

1.12 ADJUSTMENT OF CONTRACT COMPLETION

- A. The Contract completion time will be adjusted only for causes specified in this Contract. Request for an extension of the Contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in workdays) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The COR's determination as to the total number of days of Contract extension will be based upon the current computer-produced, calendar-dated schedule for the time period in question and all other relevant information.
- B. Actual delays in activities/events which, according to the computer-produced, calendar-dated schedule, do not affect the extended and predicted Contract completion dates shown by the critical path in the network, will not be the basis for a change to the Contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the COR's decision.
- C. The Contractor shall submit each request for a change in the Contract completion date to the COR in accordance with the provisions specified under FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in

workdays) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.

- D. All delays due to non-work activities/events such as REQUESTS FOR INFORMATION, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month-by-month basis.

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SECTION 01 33 23
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- 1-1 Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2 For the purposes of this Contract, samples (including laboratory samples to be tested), test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3 Submit for approval, all of the items specifically mentioned under the separate Sections of the Specification, with information sufficient to evidence full compliance with Contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
- A. Satisfactory written evidence is presented to, and approved by Contracting Officer (COR), that manufacturer cannot make scheduled delivery of approved item or;
 - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4 Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of Contract-required items. Delays attributable to untimely and rejected submittals (including any laboratory samples to be tested) will not serve as a basis for extending Contract time for completion.
- 1-5 Submittals will be reviewed for compliance with Contract requirements by COR, or Architect-Engineer, and action thereon will be taken by COR on behalf of the Contracting Officer.
- 1-6 Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.

- 1-7 The Government reserves the right to require additional submittals, whether or not particularly mentioned in this Contract. If additional submittals beyond those required by the Contract are furnished pursuant to request therefor by COR, adjustment in Contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.
- 1-8 Schedules called for in Specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The COR and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9 Submittals must be submitted by Contractor only and shipped prepaid. COR assumes no responsibility for checking quantities or exact numbers included in such submittals.
- A. Submit samples required by each Specification Section and the Finish Schedule on the Drawings, in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
- B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center, name of Contractor, Contract number, applicable specification paragraph numbers, applicable Drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by Specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on Project.

3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the Specification shall be tested, at the expense of Contractor, in a commercial laboratory approved by COR.
1. Laboratory shall furnish COR with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with Specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
 2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past 5 years.
 3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
 4. Contractor shall send a copy of transmittal letter to both COR and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
 5. Laboratory test reports shall be sent directly to COR for appropriate action.
 6. Laboratory reports shall list Contract Specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets Specification requirements, the laboratory shall so certify on test report.
 7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- E. Approved samples will be kept on file by the COR at the site until completion of Contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of Specifications, approved samples in good condition may be used in their proper locations in Contract Work. At completion of Contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior

to completion of the Contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of Contract.

F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with Contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.

1. For each Drawing required, submit one legible photographic paper or vellum reproducible.
2. Reproducible shall be full size.
3. Each Drawing shall have marked thereon, proper descriptive title, including Medical Center location, Project number, manufacturer's number, reference to Contract Drawing number, detail Section number, and Specification Section number.
4. A space 4-3/4 by 5 inches shall be reserved on each Drawing to accommodate approval or disapproval stamp.
5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
7. When work is directly related and involves more than one trade, shop drawings shall be submitted to the COR under one cover.

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SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the availability and source of references and standards specified in the Project Manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the Drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

- A. The specifications and standards cited in this Solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
425 Eye Street, N.W. (Sixth Floor)
Washington, DC 20001
Telephone Numbers: (202) 632-5249 or (202) 632-5178
Between 9:00 a.m. - 3:00 p.m.

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

A. The Specifications cited in this Solicitation may be obtained from the associations or organizations listed below.

AA	Aluminum Association Inc. http://www.aluminum.org
AABC	Associated Air Balance Council http://www.aabchq.com
AAMA	American Architectural Manufacturer's Association http://www.aamanet.org
AAN	American Nursery and Landscape Association http://www.anla.org
AASHTO	American Association of State Highway and Transportation Officials http://www.aashto.org
AATCC	American Association of Textile Chemists and Colorists http://www.aatcc.org
ACGIH	American Conference of Governmental Industrial Hygienists http://www.acgih.org
ACI	American Concrete Institute http://www.aci-int.net
ACPA	American Concrete Pipe Association http://www.concrete-pipe.org
ACPPA	American Concrete Pressure Pipe Association http://www.acppa.org
ADC	Air Diffusion Council http://flexibleduct.org
AGA	American Gas Association http://www.aga.org
AGC	Associated General Contractors of America http://www.agc.org

AGMA	American Gear Manufacturers Association, Inc. http://www.agma.org
AHAM	Association of Home Appliance Manufacturers http://www.aham.org
AISC	American Institute of Steel Construction http://www.aisc.org
AISI	American Iron and Steel Institute http://www.steel.org
AITC	American Institute of Timber Construction http://www.aitc-glulam.org
AMCA	Air Movement and Control Association, Inc. http://www.amca.org
ANLA	American Nursery & Landscape Association http://www.anla.org
ANSI	American National Standards Institute, Inc. http://www.ansi.org
APA	The Engineered Wood Association http://www.apawood.org
ARI	Air-Conditioning and Refrigeration Institute http://www.ari.org
ASAE	American Society of Agricultural Engineers http://www.asae.org
ASCE	American Society of Civil Engineers http://www.asce.org
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASSE	American Society of Sanitary Engineering http://www.asse-plumbing.org

ASTM	American Society for Testing and Materials http://www.astm.org
AWI	Architectural Woodwork Institute http://www.awinet.org
AWS	American Welding Society http://www.aws.org
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIA	Brick Institute of America http://www.bia.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CI	The Chlorine Institute, Inc. http://www.chlorineinstitute.org
CISCA	Ceilings and Interior Systems Construction Association http://www.cisca.org
CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org
CLFMI	Chain Link Fence Manufacturers Institute http://www.chainlinkinfo.org
CPMB	Concrete Plant Manufacturers Bureau http://www.cpmb.org
CRA	California Redwood Association http://www.calredwood.org
CRSI	Concrete Reinforcing Steel Institute http://www.crsi.org

CTI	Cooling Technology Institute http://www.cti.org
DHI	Door and Hardware Institute http://www.dhi.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EEI	Edison Electric Institute http://www.eei.org
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.etl.com
FAA	Federal Aviation Administration http://www.faa.gov
FCC	Federal Communications Commission http://www.fcc.gov
FPS	The Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.cssinfo.com/info/gana.html/
FM	Factory Mutual Insurance http://www.fmglobal.com
GA	Gypsum Association http://www.gypsum.org
GSA	General Services Administration http://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
HPVA	Hardwood Plywood & Veneer Association http://www.hpva.org

ICBO	International Conference of Building Officials http://www.icbo.org
ICEA	Insulated Cable Engineers Association Inc. http://www.icea.net
ICAC	Institute of Clean Air Companies http://www.icac.com
IEEE	Institute of Electrical and Electronics Engineers http://www.ieee.org/
IMSA	International Municipal Signal Association http://www.imsasafety.org
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association http://www.mbma.com
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. http://www.mss-hq.com
NAAMM	National Association of Architectural Metal Manufacturers http://www.naamm.org
NAPHCC	Plumbing-Heating-Cooling Contractors Association http://www.phccweb.org.org
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors http://www.nationboard.org
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association http://www.nema.org
NFPA	National Fire Protection Association http://www.nfpa.org

NHLA National Hardwood Lumber Association
<http://www.natlhardwood.org>

NIH National Institute of Health
<http://www.nih.gov>

NIST National Institute of Standards and Technology
<http://www.nist.gov>

NLMA Northeastern Lumber Manufacturers Association, Inc.
<http://www.nelma.org>

NPA National Particleboard Association
18928 Premiere Court
Gaithersburg, MD 20879
(301) 670-0604

NSF National Sanitation Foundation
<http://www.nsf.org>

NWWDA Window and Door Manufacturers Association
<http://www.nwwda.org>

OSHA Occupational Safety and Health Administration
Department of Labor
<http://www.osha.gov>

PCA Portland Cement Association
<http://www.portcement.org>

PCI Precast Prestressed Concrete Institute
<http://www.pci.org>

PPI The Plastic Pipe Institute
<http://www.plasticpipe.org>

PEI Porcelain Enamel Institute, Inc.
<http://www.porcelainenamel.com>

PTI Post-Tensioning Institute
<http://www.post-tensioning.org>

RFCI The Resilient Floor Covering Institute
<http://www.rfci.com>

RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. http://www.rma.org
SCMA	Southern Cypress Manufacturers Association http://www.cypressinfo.org
SDI	Steel Door Institute http://www.steeldoor.org
IGMA	Insulating Glass Manufacturers Alliance http://www.igmaonline.org
SJI	Steel Joist Institute http://www.steeljoist.org
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. http://www.smacna.org
SSPC	The Society for Protective Coatings http://www.sspc.org
STI	Steel Tank Institute http://www.steeltank.com
SWI	Steel Window Institute http://www.steelwindows.com
TCA	Tile Council of America, Inc. http://www.tileusa.com
TEMA	Tubular Exchange Manufacturers Association http://www.tema.org
TPI	Truss Plate Institute, Inc. 583 D'Onofrio Drive, Suite 200 Madison, WI 53719 (608) 833-5900
UBC	The Uniform Building Code See ICBO

UL Underwriters' Laboratories Incorporated
<http://www.ul.com>

ULC Underwriters' Laboratories of Canada
<http://www.ulc.ca>

WCLIB West Coast Lumber Inspection Bureau
6980 SW Varns Road, P.O. Box 23145
Portland, OR 97223
(503) 639-0651

WRCLA Western Red Cedar Lumber Association
P.O. Box 120786
New Brighton, MN 55112
(612) 633-4334

WWPA Western Wood Products Association
<http://www.wwpa.org>

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various Contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
 - 1. Adversely effect human health or welfare,
 - 2. Unfavorably alter ecological balances of importance to human life,
 - 3. Effect other species of importance to humankind, or;
 - 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
 - 1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 - 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
 - 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
 - 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
 - 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
 - 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

7. Sanitary Wastes:

- a. Sewage: Domestic sanitary sewage and human and animal waste.
- b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

1.3 REFERENCES

- 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. U.S. National Archives and Records Administration (NARA):
33 CFR 328.....Definitions

1.4 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the Project boundaries and those affected outside the limits of permanent work during the entire period of this Contract. Confine activities to areas defined by the Specifications and Drawings.
 - 1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this Contract.
 - 2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features by marking, fencing, or using any other approved techniques.
 - a. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - b. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
 - 3. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
 - 4. Store chemical waste away from the work areas in corrosion-resistant containers and dispose of waste in accordance with Federal, State, and local regulations.

5. Handle discarded materials other than those included in the solid waste category as directed by the Contracting Officer's Representative (COR).
- B. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems.
- C. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the jobsite.
 1. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- D. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
 1. Perform construction activities involving repetitive, high-level-impact noise only between 8:00 a.m. and 6:00 p.m. unless otherwise permitted by the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than 3 minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this Contract, consisting of, but not limited to, the following:
 - a. Maintain maximum permissible construction equipment noise levels at 50 feet (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCRAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80

EARTHMOVING		MATERIALS HANDLING	
PUMPS	75	BLASTING	not permitted
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

- b. Use shields or other physical barriers to restrict noise transmission.
 - c. Provide soundproof housings or enclosures for noise-producing machinery.
 - d. Use efficient silencers on equipment air intakes.
 - e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - f. Line hoppers and storage bins with sound deadening material.
 - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every 5 successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure 50 feet from the noise source. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. Submit the recorded information to the COR noting any problems and the alternatives for mitigating actions.
- E. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- F. Final Cleanup: On completion of Project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the COR. Cleaning shall include off-the-station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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SECTION 01 58 16
TEMPORARY INTERIOR SIGNAGE

PART 1 GENERAL

DESCRIPTION

- A. This Section specifies temporary interior signs.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNS

- A. Fabricate from 110-pound, matte finish white paper.
- B. Cut to 4-inch-wide by 12-inch-long size tag.
- C. Punch 1/8-inch-diameter hole centered on 4-inch dimension of tag. Edge of hole spaced approximately 1/2-inch from one end on tag.
- D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.
- E. Ties: Steel wire 0.0120-inch thick, attach to tag with twist tie, leaving 6-inch-long free ends.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.
- B. Mark on signs with felt tip marker having approximately 1/8-inch-wide stroke for clearly legible numbers or letters.
- C. Identify room with numbers as designated on Floor Plans.

3.2 LOCATION

- A. Install on doors that have room, corridor, and space numbers shown.
- B. Doors that do not require signs are as follows:
1. Corridor barrier doors (cross-corridor) in corridor with same number.
 2. Folding doors or partitions.
 3. Toilet or bathroom doors within and between rooms.
 4. Communicating doors in partitions between rooms with corridor entrance doors.
 5. Closet doors within rooms.
- C. Replace missing, damaged, or illegible signs.

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
 - 1. Waste Management Plan development and implementation.
 - 2. Techniques to minimize waste generation.
 - 3. Sorting and separating of waste materials.
 - 4. Salvage of existing materials and items for reuse or resale.
 - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
 - 1. Soil.
 - 2. Inerts (e.g., concrete, masonry and asphalt).
 - 3. Clean dimensional wood and palette wood.
 - 4. Green waste (biodegradable landscaping materials).
 - 5. Engineered wood products (plywood, particle board and I-joists, etc.).
 - 6. Metal products (e.g., steel, wire, beverage containers, copper, etc.).
 - 7. Cardboard, paper and packaging.
 - 8. Bitumen roofing materials.
 - 9. Plastics (e.g., ABS, PVC).
 - 10. Carpet and/or pad.
 - 11. Gypsum board.
 - 12. Insulation.
 - 13. Paint.
 - 14. Fluorescent lamps.

1.2 RELATED WORK

- A. Section 02 41 00, SELECTIVE DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction/demolition waste includes products of the following:
 - 1. Excess or unusable construction materials.
 - 2. Packaging used for construction products.
 - 3. Poor planning and/or layout.
 - 4. Construction error.
 - 5. Over ordering.
 - 6. Weather damage.
 - 7. Contamination.
 - 8. Mishandling.
 - 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the Contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org/tools/cwm.php> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to

be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
 - 1. On-Site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e., concrete crushed for use as a sub-base in paving.
 - 2. Off-Site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

B. Prepare and submit to the Contracting Officer's Representative (COR) a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Procedures to be used for debris management.
2. Techniques to be used to minimize waste generation.
3. Analysis of the estimated jobsite waste to be generated.
 - a. List of each material and quantity to be salvaged, reused, or recycled.
 - b. List of each material and quantity proposed to be taken to a landfill.
4. Detailed description of the Means/Methods to be used for material handling.
 - a. On-Site: Material separation, storage, protection where applicable.
 - b. Off-Site: Transportation means and destination. Include list of materials.
 - 1) Description of materials to be site-separated and self-hauled to designated facilities.
 - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
 - c. The names and locations of mixed debris reuse and recycling facilities or sites.
 - d. The names and locations of trash disposal landfill facilities or sites.
 - e. Documentation that the facilities or sites are approved to receive the materials.

C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this Specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

B. U.S. Green Building Council (USGBC):

LEED Green Building Rating System for New Construction

1.7 RECORDS

- A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. List of each material and quantity to be salvaged, recycled, or reused.
B. List of each material and quantity proposed to be taken to a landfill.
C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.

- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, or invoices. Include the net total costs for each disposal.

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SECTION 02 41 00
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies demolition and removal of portions of existing buildings and utilities as required for the installation of new work.

1.2 RELATED WORK

- A. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- E. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.

1.3 PROTECTION

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, and other similar items that are required for protection of all personnel during demolition and removal operations.
- C. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
 - 1. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
- D. Before beginning any demolition work, the Contractor shall survey the site and examine the Drawings and Specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the Contracting Officer's Representative (COR). The Contractor shall coordinate the work of this Section with all other work and shall construct and maintain shoring, bracing, and

supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this Contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have COR's approval.

- H. The Work shall comply with the requirements of Section 01 57 19,
TEMPORARY ENVIRONMENTAL CONTROLS.

1.4 JOB CONDITIONS

- A. The Owner will be continuously occupying the portions of the building outside Project limits. Coordinate all demolition work with COR in order to minimize disruptions to Owner's normal operations.
- B. Do not interrupt existing utilities serving occupied portions of the building without permission from the COR. Provide temporary services as required by COR during interruptions to existing utilities.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION

- A. Completely demolish and remove portions of structures, including all appurtenances related or connected thereto, as required and indicated in the Drawings. Notify COR immediately of any unanticipated mechanical, electrical or structural elements which are found in conflict with demolition activities or new work.
- B. Debris, including concrete masonry unit, concrete, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

3.2 CLEANUP

- A. On completion of work of this Section and after removal of all debris, leave site in clean condition satisfactory to COR. Cleanup shall include off the Medical Center disposal of all items and materials not required to remain property of the Government, as well as all debris and rubbish resulting from demolition operations.

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SECTION 03 30 53
(SHORT-FORM) CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies cast-in-place structural concrete and material and mixes for other concrete.

1.2 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

1.3 TOLERANCES

- A. ACI 117.

1.4 REGULATORY REQUIREMENTS

- A. ACI SP-66 ACI Detailing Manual.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Concrete Mix Design.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
 - 117-10.....Specification for Tolerances for Concrete Construction, Materials and Commentary
 - 211.1-91(R2009).....Standard Practice for Proportions for Normal, Heavyweight, and Mass Concrete
 - 211.2-98(R2004).....Standard Practice for Selecting Proportions for Structural Lightweight Concrete
 - 301-10.....Specifications for Structural Concrete
 - 305.1-06.....Specification for Hot Weather Concreting
 - 306.1-90(R2002).....Standard Specification for Cold Weather Concreting
 - SP-66-04ACI Detailing Manual
 - 318-11.....Building Code Requirements for Structural Concrete and Commentary
 - 347-04.....Guide to Formwork for Concrete

C. American Society for Testing and Materials (ASTM):

A185/A185M-07.....Standard Specification for Steel Welded Wire
Reinforcement, Plain, for Concrete Reinforcement

A615/A615M-09.....Standard Specification for Deformed and Plain
Carbon Steel Bars for Concrete Reinforcement

A996/A996M-09.....Standard Specification for Rail Steel and Axle
Steel Deformed Bars for Concrete Reinforcement

C31/C31M-10.....Standard Practice for Making and Curing Concrete
Test Specimens in the Field

C33/C33M-11a.....Standard Specification for Concrete Aggregates

C39/C39M-12.....Standard Test Method for Compressive Strength of
Cylindrical Concrete Specimens

C94/C94M-12.....Standard Specification for Ready Mixed Concrete

C143/C143M-10.....Standard Test Method for Slump of Hydraulic
Cement Concrete

C150-11.....Standard Specification for Portland Cement

C171-07.....Standard Specification for Sheet Material for
Curing Concrete

C172-10.....Standard Practice for Sampling Freshly Mixed
Concrete

C173-10.....Standard Test Method for Air Content of Freshly
Mixed Concrete by the Volumetric Method

C192/C192M-07.....Standard Practice for Making and Curing Concrete
Test Specimens in the Laboratory

C231-10.....Standard Test Method for Air Content of Freshly
Mixed Concrete by the Pressure Method

C260-10.....Standard Specification for Air-Entraining
Admixtures for Concrete

C330-09.....Standard Specification for Lightweight
Aggregates for Structural Concrete

C494/C494M-11.....Standard Specification for Chemical Admixtures
for Concrete

C618-12.....Standard Specification for Coal Fly Ash and Raw
or Calcined Natural Pozzolan for Use in Concrete

D1751-04(R2008)Standard Specification for Preformed Expansion
Joint Fillers for Concrete Paving and Structural
Construction (Non-extruding and Resilient
Bituminous Types)

D4397-10.....Standard Specification for Polyethylene Sheeting
for Construction, Industrial and Agricultural
Applications

E1155-96(2008).....Standard Test Method for Determining F_F Floor
Flatness and F_L Floor Levelness Numbers

PART 2 - PRODUCTS

2.1 FORMS

- A. Wood, plywood, metal, or other materials, approved by Resident Engineer, of grade or type suitable to obtain type of finish specified.

2.2 MATERIALS

- A. Portland Cement: ASTM C150, Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33, Size 67. Size 467 may be used for footings and walls over 12 inches thick. Coarse aggregate for applied topping and metal pan stair fill shall be Size 7.
- D. Fine Aggregate: ASTM C33.
- E. Mixing Water: Fresh, clean, and potable.
- F. Air-Entraining Admixture: ASTM C260.
- G. Chemical Admixtures: ASTM C494.
- H. Reinforcing Steel: ASTM A615 or ASTM A996, deformed. See Structural Drawings for grade.
- I. Welded Wire Fabric: ASTM A185.
- J. Expansion Joint Filler: ASTM D1751.
- K. Sheet Materials for Curing Concrete: ASTM C171.
- L. Liquid Hardener and Dustproofer: Fluosilicate solution or magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer.
- M. Liquid Densifier/Sealer: 100 percent active colorless aqueous silicate solution.

2.3 CONCRETE MIXES

- A. Design of concrete mixes using materials specified shall be the responsibility of the Contractor as set forth under Option C of ASTM C94.
- B. Compressive strength at 28 days shall be not less than 4,000 psi.
- C. Establish strength of concrete by testing prior to beginning concreting operation. Test consists of average of 3 cylinders made and cured in accordance with ASTM C192 and tested in accordance with ASTM C39.

D. Maximum slump for vibrated concrete is 4 inches tested in accordance with ASTM C143.

E. Cement and water factor (See Table I):

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete: Strength	Non-Air-Entrained		Air-Entrained	
Min. 28-Day Comp. Str. psi	Min. Cement lbs/c. yd.	Max. Water Cement Ratio	Min. Cement lbs/c. yd.	Max. Water Cement Ratio
4,000	550	0.55	570	0.50

F. Air-entrainment is required for all exterior concrete. Air content shall conform to the following table:

**TABLE I - TOTAL AIR CONTENT
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Coarse Aggregate	Total Air Content Percentage by Volume
3/8-inch	6 to 10
1/2-inch	5 to 9
3/4-inch	4 to 8
1 inch	3-1/2 to 6-1/2
1-1/2 inches	3 to 6

2.4 BATCHING AND MIXING

A. Store, batch, and mix materials as specified in ASTM C94.

1. Ready-Mixed: Ready-mixed concrete comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will not be permitted. With each load of concrete delivered to Project, ready-mixed concrete producer shall furnish, in duplicate, certification as required by ASTM C94.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Installation conforms to ACI 347. Sufficiently tight to hold concrete without leakage, sufficiently braced to withstand vibration of concrete, and to carry, without appreciable deflection, all dead and live loads to which they may be subjected.

B. Treating and Wetting: Treat or wet contact forms as follows:

1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
3. Use sealer on reused plywood forms as specified for new material.

C. Construction Tolerances:

1. Contractor is responsible for setting and maintaining concrete formwork to assure erection of completed work within tolerances specified to accommodate installation or other rough and finish materials. Remedial work necessary for correcting excessive tolerances is the responsibility of the Contractor. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
2. Permissible surface irregularities for various classes of materials are defined as "finishes" in Specification Sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 REINFORCEMENT

- A. Details of concrete reinforcement, unless otherwise shown, in accordance with ACI 318 and ACI SP-66. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

3.3 VAPOR BARRIER

- A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier, to match existing.
- B. Lap joints 6 inches, and seal with a compatible pressure-sensitive tape.
- C. Patch punctures and tears.

3.4 PLACING CONCRETE

- A. Before placing new concrete on or against concrete which has set, existing surfaces shall be roughened and cleaned free from all laitance, foreign matter, and loose particles.
- B. Convey concrete from mixer to final place of deposit by method which will prevent segregation or loss of ingredients. Do not deposit in work concrete that has attained its initial set or has contained its water or cement more than 1-1/2 hours. Do not allow concrete to drop freely more than 5 feet in unexposed work or more than 3 feet in exposed work. Place

and consolidate concrete in horizontal layers not exceeding 12 inches in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Vibration shall be carried on continuously with placing of concrete.

- C. Hot Weather Placing of Concrete: Follow recommendations of ACI 305R to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.
- D. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 12 inches and to permit concrete to gain strength properly, except that use of calcium chloride shall not be permitted without written approval from Contracting Officer's Representative (COR).

3.5 PROTECTION AND CURING

- A. Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by COR.

3.6 FORM REMOVAL

- A. Forms remain in place until concrete has a sufficient strength to carry its own weight and loads supported. Removal of forms at any time is the Contractor's sole responsibility.

3.7 SURFACE PREPARATION

- A. Immediately after forms have been removed and work has been examined and approved by COR, remove loose materials, and patch all stone pockets, surface honeycomb, or similar deficiencies with cement mortar made with 1 part portland cement and 2 to 3 parts sand.

3.8 FINISHES

- A. Vertical and Overhead Surface Finishes:
 - 1. Unfinished Areas: Vertical and overhead concrete surfaces exposed in unfinished areas, above suspended ceilings in manholes, and other unfinished areas exposed or concealed will not require additional finishing.
 - 2. Interior and Exterior Exposed Areas (to be painted): Fins, burrs and similar projections on surface shall be knocked off flush by mechanical means approved by COR and rubbed lightly with a fine abrasive stone or hone. Use an ample amount of water during rubbing without working up a lather of mortar or changing texture of concrete.
- B. Slab Finishes:

1. Scratch Finish: Slab surfaces to receive a bonded, applied cementitious application shall all be thoroughly raked or wire broomed after partial setting (within 2 hours after placing) to roughen surface to insure a permanent bond between base slab and applied cementitious materials.
2. Floating: Allow water brought to surface by float used for rough finishing to evaporate before surface is again floated or troweled. Do not sprinkle dry cement on surface to absorb water.
3. Float Finish: Ramps, stair treads, and platforms, both interior and exterior, equipment pads, and slabs to receive non-cementitious materials, except as specified, shall be screened and floated to a smooth dense finish. After first floating, while surface is still soft, surfaces shall be checked for alignment using a straightedge or template. Correct high spots by cutting down with a trowel or similar tool and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat the slab to a uniform sandy texture.
4. Steel Trowel Finish: Applied toppings, concrete surfaces to receive resilient floor covering or carpet, and all monolithic concrete floor slabs exposed in finished work and for which no other finish is shown or specified shall be steel troweled. Final steel troweling to secure a smooth, dense surface shall be delayed as long as possible, generally when the surface can no longer be dented with finger. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure on trowel to compact cement paste and form a dense, smooth surface. Finished surface shall be free of trowel marks, uniform in texture and appearance.

3.9 SURFACE TREATMENTS

- A. Surface treatments shall be mixed and applied in accordance with manufacturer's printed instructions.
- B. Liquid Densifier/Sealer: Use on all exposed concrete floors and concrete floors to receive carpeting, except those specified to receive non-slip finish.

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SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies interior millwork.
- B. Items Specified:
 - 1. Benches
 - 2. Counter or Work Tops
 - 3. Mounting Strips, Shelves, and Rods

1.2 RELATED WORK

- A. Fabricated Metal Brackets, Bench Supports and Countertop Legs: Section 05 50 00, METAL FABRICATIONS.
- B. Wood Doors: Section 08 14 00, WOOD DOORS.
- D. Color and Texture of Finish: As indicated in the Finish Schedule on the Drawings.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Millwork items - Half-full-size scale for sections and details 1:50 (1/4-inch) for elevations and Plans.
 - 2. Show construction and installation.
- C. Samples: Plastic laminate finished plywood, 6 by 12 inches.
- D. Certificates:
 - 1. Indicating fire-retardant treatment of materials, meet the requirements specified.
 - 2. Indicating moisture content of materials, meet the requirements specified.
- E. Manufacturer's Literature and Data:
 - 1. Finish hardware.
 - 2. Sinks with fittings.
 - 3. Electrical components.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.
- B. Store finishing lumber and millwork in weathertight, well-ventilated structures or in space in existing buildings designated by Contracting

Officer's Representative (COR). Store at a minimum temperature of
70 degrees F for not less than 10 days before installation.

- C. Pile lumber in stacks in such manner as to provide air circulation
around surfaces of each piece.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the
extent referenced. The publications are referenced in the text by the
basic designation only.
- B. American Society of Testing and Materials (ASTM):
- A36/A36M-08.....Structural Steel
 - A53-12.....Pipe, Steel, Black and Hot-Dipped Zinc Coated,
Welded and Seamless
 - A167-99 (R2009).....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet, and Strip
 - B26/B26M-09.....Aluminum-Alloy Sand Castings
 - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods,
Wire, Profiles, and Tubes
 - E84-10.....Surface Burning Characteristics of Building
Materials
- C. American Hardboard Association (AHA):
- A135.4-04.....Basic Hardboard
- D. Builders Hardware Manufacturers Association (BHMA):
- A156.9-03.....Cabinet Hardware
 - A156.11-10.....Cabinet Locks
 - A156.16-08.....Auxiliary Hardware
- E. Hardwood Plywood and Veneer Association (HPVA):
- HP1-09.....Hardwood and Decorative Plywood
- F. American Wood-Preservers' Association (AWPA):
- AWPA C1-03.....All Timber Products - Preservative Treatment by
Pressure Processes
- G. Architectural Woodwork Institute (AWI):
- AWI-09.....Architectural Woodwork Quality Standards and
Quality Certification Program
- H. National Electrical Manufacturers Association (NEMA):
- LD 3-05.....High-Pressure Decorative Laminates
- I. U.S. Department of Commerce, Product Standard (PS):
- PS20-10.....American Softwood Lumber Standard
- J. Military Specification (Mil. Spec):
- MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

K. Federal Specifications (Fed. Spec.):

A-A-1922A.....Shield Expansion
A-A-1936.....Contact Adhesive
FF-N-836D.....Nut, Square, Hexagon Cap, Slotted, Castle
FF-S-111D(1).....Screw, Wood
MM-L-736(C).....Lumber, Hardwood

PART 2 - PRODUCTS

2.1 LUMBER

A. Grading and Marking:

1. Lumber shall bear the grade mark, stamp, or other identifying marks indicating grades of material.
2. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
3. The inspection agency for lumber shall be approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Sizes:

1. Lumber size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.
2. Millwork, Standing and Running Trim, and Rails: Actual size as shown or specified.

C. Hardwood: MM-L-736, species as specified for each item.

D. Softwood: PS-20, exposed to view appearance grades:

1. Use C select or D select, vertical grain for transparent finish including stain transparent finish.
2. Use prime for painted or opaque finish.

2.2 PLYWOOD

A. Softwood Plywood:

1. Production standard.
2. Grading and Marking:
 - a. Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.
 - b. The mark shall identify the plywood by species group or identification index, and shall show glue type, grade, and compliance with PS1.

3. Plywood, 1/2-inch and thicker; not less than 5-ply construction,
except 1-1/4-inch-thick plywood not less than 7-ply.

4. Plastic Laminate Plywood Cores:
a. Exterior type, and species group.
b. Veneer Grade: A-C.

5. Shelving Plywood:
a. Interior type, any species group.
b. Veneer Grade: A-B or B-C.

6. Other: As specified for item.

B. Hardwood Plywood:

1. HPVA: HP.1
2. Species of face veneer shall be as shown or as specified in
connection with each particular item.
3. Inside of Building:
a. Use Type II (interior), A-grade veneer for transparent finish.
4. Use wood species and cut, matching existing wood products.

2.3 PARTICLEBOARD

A. The use of particleboard or plastic laminate particleboard cores is not
allowed.

2.4 PLASTIC LAMINATE

A. NEMA LD-3.
B. Exposed decorative surfaces including countertops, both sides of cabinet
doors, and for items having plastic laminate finish. General purpose,
Type HGL.
C. Cabinet Interiors Including Shelving: Both of following options to
comply with NEMA, CLS as a minimum.
1. Plastic-laminate-clad plywood or particle board.
2. Resin-impregnated decorative paper thermally fused to particleboard.
D. Backing sheet on bottom of plastic-laminate-covered wood tops: Backer,
Type HGP.
E. Post Forming Fabrication, Decorative Surfaces: Post forming, Type HGP.

2.5 ADHESIVE

A. For Plastic Laminate: Fed. Spec. A-A-1936.
B. For Interior Millwork: Unextended urea resin, unextended melamine resin,
phenol resin, or resorcinol resin.

2.6 STAINLESS STEEL

A. ASTM A167, Type 302 or 304.

2.7 ALUMINUM CAST

- A. ASTM B26.

2.8 ALUMINUM EXTRUDED

- A. ASTM B221.

2.9 HARDWARE

A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium-plated, or zinc-coated by electric-galvanizing process. Galvanized where specified.
2. Use galvanized coating on ferrous metal for exterior work unless non-ferrous metals or stainless is used.
3. Fasteners:
 - a. Bolts with Nuts: FF-N-836.
 - b. Expansion Bolts: A-A-1922A.
 - c. Screws: Fed. Spec. FF-S-111.

B. Finish Hardware:

1. Cabinet Hardware: ANSI A156.9.
 - a. Door/Drawer Pulls: B02011. Door in seismic zones: B03182.
 - b. Drawer Slides: B05051 for drawers over 6 inches deep, B05052 for drawers 3 to 6 inches deep, and B05053 for drawers less than 3 inches deep.
 - c. Sliding Door Tracks: B07063.
 - d. Adjustable Shelf Standards: B4061 with shelf rest B04083.
 - e. Concealed Hinges: B1601, minimum 110-degree opening.
 - f. Butt Hinges: B01361 for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
 - g. Cabinet Door Catch: B0371 or B03172.
 - h. Vertical-Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.
2. Cabinet Locks: ANSI A156.11.
 - a. Drawers and Hinged Door: E07262.
 - b. Sliding Door: E07162.
3. Auxiliary Hardware: ANSI A156.16.
 - a. Shelf Bracket: B04041, japanned or enameled finish.
 - b. Combination Garment rod and Shelf Support: B04051 japanned or enamel finish.
 - c. Closet Bar: L03131 chrome finish of required length.
 - d. Handrail Brackets: L03081 or L03101.

- 1) Cast aluminum, satin polished finish.
- 2) Cast malleable iron, japanned or enamel finish.
4. Steel Channel Frame and Leg Supports for Countertop: Fabricated under Section 05 50 00, METAL FABRICATIONS.
5. Pipe Bench Supports:
 - a. Pipe: ASTM A53.
6. Fabricated Wall Bench Supports:
 - a. Steel Angles: ASTM A36 steel with chrome finish, or ASTM A167, stainless steel with countersunk wood screws, holes at 2-1/2 inches on center on horizontal member.
 - b. Use 1-1/2- by 1-1/2- by 3/16-inch angle thick drilled for screw and bolt holes unless shown otherwise. Drill 1/4-inch holes for anchors on vertical member, not more than 8 inches on center between ends or corners.
 - c. Stainless-Steel Bar Brackets: ASTM A167, fabricated to shapes shown, Number 4 finish. Use 2-inch by 3/16-inch bars unless shown otherwise. Drill for anchors and screws. Drill countersunk wood screw holes at 2-1/2 inches on center on horizontal members and not less than two 1/4-inch holes for anchors on vertical member.
7. Through-Wall Counter Brackets:
 - a. Steel angles drilled for fasteners on 4-inch centers.
 - b. Baked enamel prime coat finish.
8. Edge Strips Moldings:
 - a. Driven Type "T" shape with serrated retaining stem; vinyl plastic to match plastic laminate color, stainless steel, or 1/8-inch-thick extruded aluminum.
 - b. Stainless steel or extruded aluminum channels.
 - c. Stainless steel, number 4 finish; aluminum, mechanical applied medium satin finish, clear anodized 0.4 mils thick.
9. Rubber or Vinyl Molding:
 - a. Rubber or vinyl standard stock and in longest lengths practicable.
 - b. Design for closures at joints with walls and adhesive anchorage.
 - c. Adhesive as recommended by molding manufacturer.
10. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

2.10 MOISTURE CONTENT

- A. Moisture content of lumber and millwork at time of delivery to site.

1. Interior finish lumber, trim, and millwork 1-1/4 inches or less in nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
2. Exterior treated or untreated finish lumber and trim 4 inches or less in nominal thickness: 15 percent.
3. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

2.11 FIRE-RETARDANT TREATMENT

- A. Where wood members and plywood are specified to be fire-retardant treated, the treatment shall be in accordance with Mil. Spec. MIL-L19140.
- B. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings.
- C. Each piece of treated material shall bear identification of the testing agency and shall indicate performance in accordance with such rating of flame spread and smoke developed.
- D. Treat wood for maximum flame spread of 25 and smoke developed of 25.
- E. Fire-Resistant Softwood Plywood:
 1. Use Grade A, exterior, plywood for treatment.
 2. Meet the following requirements when tested in accordance with ASTM E84:
 - a. Flame Spread: 0 to 25.
 - b. Smoke Developed: 100 maximum

2.12 PRESERVATIVE TREATMENT

- A. Wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including wood members used for rough framing of millwork items except heart-wood Redwood and Western Red Cedar shall be preservative treated in accordance with AWP Standards.
- B. Use Grade exterior plywood for treatment.

2.13 FABRICATION

- A. General:
 1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.
 2. Finish woodwork shall be free from pitch pockets.
 3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
 4. Plywood shall be not less than 1/2-inch unless otherwise shown or specified.

5. Edges of members in contact with concrete or masonry shall have a square corner caulking rebate.
6. Fabricate members less than 14 feet in length from one piece of lumber, back channeled and molded as shown.
7. Plastic Laminate Work:
 - a. Factory glued to a plywood core, thickness as shown or specified.
 - b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 3/4-inch molded thick or thinner core material.
 - c. Provide plastic backing sheet on underside of countertops, vanity tops, through-wall counter and sills including backsplashes and endsplashes of countertops.
 - d. Use backing sheet on concealed large panel surface when decorative face does not occur.
- B. Benches:
 1. Fabricate from 2-inch stock strips of plain-sawed White Oak, or Maple. Use preservative-treated softwood.
 2. Solid seats securely glued together of spliced, doweled, or double tongued and grooved wood pieces. Where open joints are indicated, work each wood piece from solid stock.
 3. Round top edges and corners where exposed.
- C. Mounting Strips, Shelves and Rods:
 1. Cut mounting strips from 1- by 4-inch softwood stock, with exposed edge slightly rounded.
 2. Cut wood shelf from softwood 1-inch stock, of width shown, exposed edge slightly rounded. Option: Use 3/4-inch-thick plywood with 3/4-inch softwood edge nosing on exposed edge, slightly rounded.
 3. Plastic laminate covered, 3/4-inch-thick plywood core with edges and ends having plastic molded edge strips. Size, finish and number as shown.
- D. Countertops or Work Tops:
 1. Fabrication with plastic laminate over 1-1/4-inch-thick core unless shown otherwise.
 - a. Use decorative laminate for exposed edges of tops 1-1/2-inch-wide and on backsplash and endsplash. Use plastic or metal edges for top edges less than 1-1/2 inches wide.
 - b. Countertops shall have a bullnose front edge as shown on the Drawings.

- c. Assemble backsplash and endsplash to countertop.
 - d. Use one-piece counters for straight runs.
 - e. Miter corners for field joints with overlapping blocking on underside of joint.
2. Fabricate wood counter for workbenches as shown.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain work areas and storage areas to a minimum temperature of 70 degrees F for not less than 10 days before and during installation of interior millwork.
- B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work are not complete and dry.

3.2 INSTALLATION

- A. General:
 - 1. Millwork receiving transparent finish shall be primed and back-painted on concealed surfaces. Set no millwork until primed and back-painted.
 - 2. Secure trim with fine finishing nails, screws, or glue as required.
 - 3. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.
 - 4. Seal cut edges of preservative and fire-retardant treated wood materials with a certified acceptable sealer.
 - 5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
 - 6. Plumb and level items unless shown otherwise.
 - 7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
- B. Benches:
 - 1. Use stainless-steel countersunk screws to secure wood seats to brackets, angle, or pipe supports.
 - 2. Freestanding Benches: Support within 8 inches of ends and not over 3 feet on centers with pipe bench supports.
- C. Shelves:
 - 1. Install mounting strip at back wall and end wall for shelves in closets where shown secured with toggle bolts at each end and not over 24-inch centers between ends.

- a. Nail Shelf to mounting strip at ends and to back wall strip at not over 36 inches on center.
 - b. Install metal bracket, ANSI A156.16, B04041, not over 4-foot centers when shelves exceed 6 feet in length.
 - c. Install metal bracket, ANSI A156.16, B04051, not over 4 feet on centers where shelf length exceeds 6 feet in length with metal rods, clothes hanger bars ANSI A156.16, L03131, of required length, full length of shelf.
2. Install vertical slotted shelf standards, ANSI A156.9, B04103 to studs with toggle bolts through each fastener opening. Double-slotted shelf standards may be used where adjacent shelves terminate.
 - a. Install brackets ANSI A156.9, B04113, providing supports for shelf not over 36 inches on center and within 1/2-inch of shelf end unless shown otherwise.
 - b. Install shelves on brackets so front edge is restrained by bracket.

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SECTION 06 61 16
SOLID POLYMER (SOLID SURFACING) FABRICATIONS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. ASTM International (ASTM):
 - ASTM D2583..... (2013) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
 - ASTM D5116..... (2010) Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products
 - ASTM D570..... (1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
 - ASTM D638..... (2010) Standard Test Method for Tensile Properties of Plastics
 - ASTM D696..... (2008; E 2013) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
 - ASTM E84..... (2013a) Standard Test Method for Surface Burning Characteristics of Building Materials
 - ASTM G21..... (2009) Determining Resistance of Synthetic Polymeric Materials to Fungi
- C. International Association Of Plumbing And Mechanical Officials (IAPMO):
 - IAPMO Z124.3..... (2005) Plastic Lavatories
 - IAPMO Z124.6..... (2007) Plastic Sinks
- D. National Electrical Manufacturers Association (NEMA):
 - ANSI/NEMA LD 3..... (2005) Standard for High-Pressure Decorative Laminates
- E. NSF International (NSF):
 - NSF/ANSI 51..... (2012) Food Equipment Materials
- F. Scientific Certification Systems (SCS):
 - SCS..... Scientific Certification Systems (SCS) Indoor Advantage
- G. Tile Council Of North America (TCNA):
 - TCNA Hdbk..... (2013) Handbook for Ceramic, Glass, and Stone Tile Installation
- H. U.S. Green Building Council (USGBC):
 - LEED NC..... (2009) Leadership in Energy and Environmental Design(tm) New Construction Rating System
- I. UL Environment (ULE):
 - ULE Greenguard..... UL Greenguard Certification Program

1.2 SYSTEM DESCRIPTION

- A. Work under this Section includes counter and transaction top and other items utilizing solid polymer (solid surfacing) fabrication as shown on the Drawings and as described in this Specification. Do not change source of supply for materials after work has started, if the appearance of finished work would be affected.
- B. In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer fabricator/installer and other trades to ensure that necessary structural wall support, cabinet countertop structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, shelving, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
 - 1. Shop Drawings: Show design and installation details.
 - 2. Manufacturer's Literature and Product Data:
 - a. Solid polymer material
 - b. Qualifications
 - c. Certification
 - 3. Samples: Submit a 4- by 4-inch sample of each indicated product.
 - 4. Test Reports: Solid polymer material.
 - 5. Operation and Maintenance Data: Cleanup.

1.4 QUALITY ASSURANCE

- A. Qualifications: To ensure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials. Submit solid polymer manufacturer's certification attesting to fabricator qualification approval.
- B. Mock-ups: Submit Detail Drawings indicating locations, dimensions, component sizes, fabrication and joint details, attachment provisions, installation details, and coordination requirements with adjacent work. Prior to final approval of shop drawings, provide a full-size mock-up of a typical countertop. The mock-up shall include all solid polymer components required to provide a completed unit. The mock-up shall utilize finishes in patterns and colors indicated on the Drawings. Should the mock-up not be approved, rework or remake it until approval is secured. Remove rejected units from the jobsite. Approved mock-up may remain as part of the finished work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver materials to Project site until areas are ready for installation. Deliver components and materials to the site undamaged,

in containers clearly marked and labeled with manufacturer's name. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation, for duration of Project.

1.6 WARRANTY

- A. Provide manufacturer's warranty of 10 years against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat. Warranty shall provide for material and labor for replacement or repair of defective material for a period of 10 years after component installation.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Provide solid polymer material that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting IAPMO Z124.3 and IAPMO Z124.6 requirements. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of 0.01-inch shall be repairable by sanding or polishing. Material thickness shall be as indicated on the Drawings. In no case shall material be less than ¼-inch in thickness. Submit a minimum 4- by 4-inch sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work. Submit test report results from an independent testing laboratory attesting that the submitted solid polymer material meets or exceeds each of the specified performance requirements.
- B. Cast, 100 Percent Acrylic Polymer Solid Surfacing Material: Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4,000 psi (max.)	ASTM D638
Hardness	55-Barcol Impressor (min.)	ASTM D2583
Thermal Expansion	0.000023-in/in/F (max.)	ASTM D696
Boiling Water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
¼-inch sheet	36 inches, ½-lb ball, no failure	
½-inch sheet	140 inches, ½-lb ball, no failure	
¾-inch sheet	200 inches, ½-lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G21

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Bacteria Growth	No growth	ASTM G21
Liquid Absorption (Weight in 24 hrs.)	0.1 percent max.	ASTM D570
Flammability		ASTM E84
Flame Spread	25 max.	
Smoke Developed	30 max.	
Sanitation	"Food Contact" approval	NSF/ANSI 51

C. Material Patterns and Colors: Patterns and colors for all solid polymer components and fabrications shall be those indicated on the Project Drawings. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

D. Surface Finish: Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be as indicated on the Drawings.

2.2 ACCESSORY PRODUCTS

- A. Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer manufacturer for use with the solid polymer materials being specified.
- B. Seam Adhesive: Seam adhesive shall be a 2-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.
- C. Panel Adhesive: Panel adhesive shall be neoprene-based panel adhesive meeting TCNA Hdbk, Underwriter's Laboratories (UL) listed. Use this adhesive to bond solid polymer components to adjacent and underlying substrates.
- D. Silicone Sealant: Sealant shall be a mildew-resistant, FDA and OSHA Nationally Recognized Testing Laboratory (NRTL) listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer. Use sealant to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures.

2.3 FABRICATIONS

- A. Components shall be factory or shop fabricated to sizes and shapes indicated, to the greatest extent practical, in accordance with

approved Shop Drawings and manufacturer's requirements. Provide factory cutouts where indicated on the Drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected. Submit product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer, joint adhesive, and sealants.

- B. Joints and Seams: Form joints and seams between solid polymer components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.
- C. Edge Finishing: Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be a bullnose as detailed on the Drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.
- D. Countertops: Fabricate all solid surfacing, solid polymer countertop components from ½-inch-thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Attach 2-inch-wide reinforcing strip of polymer material under each horizontal countertop seam. Submit a minimum 1-foot-wide by 6-inch-deep, full-size sample for each type of countertop shown on the Project Drawings. The sample shall include the edge profile as detailed on the Project Drawings. Solid polymer material shall be of a pattern and color as indicated on the Drawings. Sample shall include at least 1 seam. Approved sample shall be retained as standard for this work.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Components: Install all components and fabricated units plumb, level, and rigid. Make field joints between solid polymer components using solid polymer manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work.
- B. Silicone Sealant: Use a clear, silicone sealant or caulk to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors and ceiling. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

3.2 CLEANUP

- A. Components shall be cleaned after installation and covered to protect against damage during completion of the remaining Project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost. Component supplier will provide a repair/replace cost estimate to the General Contractor who shall approve estimate before repairs are made. Submit a minimum of 6 copies of maintenance data indicating manufacturer's care, repair and

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for Primary Care at
Michael E. DeBakey VA Medical Center, Houston, Texas
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cleaning instructions. Maintenance video shall be provided, if
available. Maintenance kit for matte finishes shall be submitted.

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SECTION 06 61 60
TRANSLUCENT RESIN PANEL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the plastic fabrication of translucent resin panels as shown and specified in the described system(s) and related accessories.
 - 1. Front of transaction desk.
- B. The extent of solid polymer fabrication is shown on the Drawings.
- C. Related Sections include the following: Section 06 20 00 FINISH CARPENTRY.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Project Pre-installation Meeting:
 - 1. Owner, Architect, Contractor, Installer shall meet at Project site within 1 week of scheduled installation.
 - 2. Review mounting conditions, installation and storage instructions, fabrication requirements, seaming and protection measures.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with conditions of Contract and Division 1 Specification Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product List: Minimum of 3 completed installations or 3 installations of similar materials and complexity. Include contact name and email address for each product.
- C. Product Data: Submit manufacturer's product data; include product description, fabrication information, and compliance with specified performance requirements.
- D. Submit product test reports from a qualified independent third party testing agency indicating each type and class of panel system complies with the Project performance requirements, based on comprehensive testing of current products. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this Project.
 - 1. Test reports required are:
 - a. Rate of Burning (ASTM D 635).
 - b. Self-Ignition Temperature (ASTM D 1929).
 - c. Density of Smoke (ASTM D 2843).
- E. Shop Drawings: Include plans, elevations, sections, panel dimensions, details, and attachments to other work.
- F. Samples for Initial Selection: Submit minimum 2-inch by 2-inch samples. Indicate full color, texture and pattern variation.

G. Samples for Verification: Submit minimum 4-inch by 4-inch sample for each type, texture, pattern and color of solid translucent resin panel plastic fabrication.

H. Mockups:

1. Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects.
2. Build mockup of each type of plastic fabrication.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Maintenance Data: Submit manufacturer's care and maintenance data, including care, repair and cleaning instructions. Include in Project closeout documents.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications:

1. Materials and systems shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least 3 consecutive years and which can show evidence of those materials being satisfactorily used on at least 3 projects of similar size, scope and location. At least 1 of the projects shall have been successful for use 1 year or longer.
2. Manufacturer must offer a documented reclamation process that will take back, at the manufacturer's cost, panels that are at their end of life cycle.
3. Manufacturer must have documented training and qualification program for fabrication and installation of plastic fabrications.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver plastic fabrications, systems and specified items in manufacturer's standard protective packaging.
- B. Do not deliver plastic fabrications, system, components and accessories to Project site until areas are ready for installation.
- C. Store materials in a flat orientation in a dry place that is not exposed to exterior elements. Materials are to be protected against damage from moisture and direct sunlight.
- D. Store in area of installation minimum of 24 hours prior to installation.
- E. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent damage or staining following installation for duration of Project.
- F. Before installing plastic fabrications, permit them to reach room temperature.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install solid polymer fabrications until spaces are enclosed and weatherproof, and ambient temperatures and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 WARRANTY

- A. Manufacturer's Special Warranty on Plastic Fabrications: Manufacturer's standard form agreeing to repair or replace units that fail in material or workmanship within the specified warranty period.
- B. Warranty Period: 1 year after Substantial Completion Date.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: Basis of Design: 3form, Inc., Salt Lake City, Utah, USA, telephone 801-649-2500.

2.2 MATERIALS

- A. 3form Chroma:
 - 1. Engineered acrylic resin
 - 2. Sheet Size: Maximum 4' x 10'.
 - 3. Thickness: Minimum ½-inch.
 - 4. Basis of Design Product: The design of plastic fabrications is based on Chroma as provided by 3form, Inc. Products from other manufacturers must be approved by the Contracting Officer's Representative (COR) prior to bidding in accordance with the Instructions to Bidders.
- B. Sheet Minimum Performance Attributes:
 - 1. Rate of Burning (ASTM D 635). Material must attain CC2 Rating for a nominal thickness of 0.060-inch and greater.
 - 2. Self-Ignition Temperature (ASTM D 1929). Material must have a self-ignition temperature greater than 850 degrees F.
 - 3. Density of Smoke (ASTM D 2843). Material must have a smoke density less than 10 percent.
 - 4. Color infusion must use water soluble dyes and penetrate at least 150 microns into material.
 - 5. Applied coatings must be low-VOC, contain non-toxic pigments, not contain any heavy metals and be approved for exterior use.
 - 6. Matte surface should be completely renewable onsite.

2.3 FABRICATION

- A. General: Fabricate plastic fabrications to designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes, profiles and other characteristics are indicated on the Drawings. Panels shall incorporate rounded, polished edges as shown on Drawings.
- B. Comply with manufacturer's written recommendations for fabrication.
- C. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.
 - 1. Sawing: Select equipment and blades suitable for type of cut required.

2. Drilling: Drills specifically designed for use with plastic products.
3. Routing.
4. Tapping.
- D. Forming: Form products to shapes indicated using the appropriate method listed below. Comply with manufacturer's written instructions.
 1. Cold bending.
 2. Hot bending.
 3. Thermoforming: Acceptable only on uncoated material.
 4. Drape forming.
 5. Matched mold forming.
 6. Mechanical forming.
- E. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaner: Type recommended by manufacturer.
- C. Standoffs/Spacers: Furnish standoffs for panel installation to keep panels clear off transaction desk surface and allow for installation of lighting as shown on the Drawings. Standoffs shall be brushed stainless steel or brushed chrome.
- D. Fasteners: Use screws designed specifically for plastics. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures.
- E. Bonding Cements: May be achieved with solvents or adhesives, suitable for use with product and application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of plastic fabrications will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for installation and comply with requirements specified.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for the installation of plastic fabrications. Sizes, profiles and other characteristics are indicated on the Drawings.
- B. Panels have a directional pattern to be maintained for the entire installation. Application of panels shall be of a single panel without seams and/or joints. Follow manufacturer's installation instructions and as shown on the Drawings.

- C. Manufacturer's shop shall fabricate items to the greatest degree possible.
- D. Installation should be performed by an authorized installer.
- E. Utilize fasteners, adhesives and bonding agents recommended by manufacturer for type of installation indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.
- F. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
- G. Panel edges shall be polished.

3.3 CLEANING AND PROTECTION

- A. Protect surfaces from damage until date of Substantial Completion. Repair work or replace damaged work, which cannot be repaired to Architect's satisfaction.

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SECTION 07 21 13
THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation."

1.2 RELATED WORK

- A. Section 09 22 16, NON-STRUCTURAL FRAMING.
- B. Section 09 29 00, GYPSUM BOARD.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Insulation, each type used.
 - 2. Adhesive, each type used.
 - 3. Tape.
- C. Certificates: Stating the type and thickness of the insulation to be installed.

1.4 STORAGE AND HANDLING

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C270-10.....Mortar for Unit Masonry
 - C516-08.....Vermiculite Loose Fill Thermal Insulation
 - C549-06.....Perlite Loose Fill Insulation
 - C552-07.....Cellular Glass Thermal Insulation
 - C553-08.....Mineral Fiber Blanket Thermal Insulation for
Commercial and Industrial Applications
 - C578-10.....Rigid, Cellular Polystyrene Thermal Insulation
 - C591-09.....Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation

C612-10.....Mineral Fiber Block and Board Thermal
Insulation
C665-06.....Mineral Fiber Blanket Thermal Insulation for
Light Frame Construction and Manufactured
Housing
C728-05 (R2010).....Perlite Thermal Insulation Board
C954-10.....Steel Drill Screws for the Application of
Gypsum Panel Products or Metal Plaster Base to
Steel Studs From 0.033-inch to 0.112-inch in
thickness
C1002-07.....Steel Self-Piercing Tapping Screws for the
Application of Gypsum Panel Products or Metal
Plaster Bases to Wood Studs or Steel Studs
D312-00(R2006).....Asphalt Used in Roofing
E84-10.....Surface Burning Characteristics of Building
Materials
F1667-11.....Driven Fasteners: Nails, Spikes and Staples

PART 2 - PRODUCTS

2.1 INSULATION - GENERAL

- A. Where acoustical or sound insulation is specified or shown for insulation, the thickness shown on the Drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the acoustical resistance specified.
- B. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.

2.2 ACOUSTICAL INSULATION

- A. Mineral Fiber Boards: ASTM C553, Type II, flexible, or Type III, semirigid (4.5-pound nominal density).
- B. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
- C. Thickness as shown; of widths and lengths to fit tight against framing.

2.3 FASTENERS

- A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.
- B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 2 inches in diameter.

- C. Impaling Pins: Steel pins with head not less than 2 inches in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

2.4 ADHESIVE

- A. As recommended by the manufacturer of the insulation.
- B. Asphalt: ASTM D312, Type III or IV.
- C. Mortar: ASTM C270, Type 0.

2.5 TAPE

- A. Pressure-sensitive adhesive on one face.
- B. Perm rating of not more than 0.50.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- B. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

3.2 ACOUSTICAL INSULATION

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure-sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure-sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- D. Where acoustical insulation is installed above suspended ceilings, install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.
- E. Where semirigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedments in insulation.

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SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire-resistant rated construction.
- B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

- A. Sealants and Application: Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- C. List of FM, UL, or WH classification number of systems installed.
- D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

1.5 WARRANTY

- A. Firestopping work subject to the terms of the Article "Warranty of Construction," FAR clause 52.246-21, except extend the warranty period to 5 years.

1.6 QUALITY ASSURANCE

- A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):

E84-10.....Surface Burning Characteristics of Building
Materials

E814-11.....Fire Tests of Through-Penetration Fire Stops

C. Factory Mutual Engineering and Research Corporation (FM):

Annual Issue Approval Guide Building Materials

D. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

Annual Issue Fire Resistance Directory

1479-10.....Fire Tests of Through-Penetration Firestops

E. Warnock Hersey (WH):

Annual Issue Certification Listings

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

- A. Use either factory-built (firestop devices) or field-erected (through-penetration firestop systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 4-inch-nominal pipe or 16 square inches in overall cross-sectional area.
- C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.
- D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
 - 1. Contain no flammable or toxic solvents.
 - 2. Have no dangerous or flammable out gassing during the drying or curing of products.
 - 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
 - 4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

- E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
 - 1. Classified for use with the particular type of penetrating material used.
 - 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
 - 3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials shall be asbestos free.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

- A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
- B. Use mineral fiber filler and bond breaker behind sealant.
- C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with E84.
- D. When used in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Submit product data and installation instructions, as required by article, submittals, after an on site examination of areas to receive firestopping.

3.2 PREPARATION

- A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 6 inches on either side of the fire rated assembly prior to applying the

firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

3.3 INSTALLATION

- A. Do not begin work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

3.4 CLEANUP AND ACCEPTANCE OF WORK

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Do not move materials and equipment to the next scheduled work area until completed Work is inspected and accepted by the COR.
- C. Clean up spills of liquid-type materials.

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK

- A. Masonry Control and Expansion Joint: Section 04 20 00, UNIT MASONRY.
- B. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.
- C. Glazing: Section 08 80 00, GLAZING.
- D. Glazed Aluminum Storefront: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- E. Sound-Rated Gypsum Partitions/Sound Sealants: Section 09 29 00, GYPSUM BOARD.
- F. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION; Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING; Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

1.3 QUALITY CONTROL

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Volatile Organic Compound (VOC): Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Manufacturer's Literature and Data:
 - 1. Caulking compound.
 - 2. Primers.
 - 3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F.
 - b. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 DELIVERY, HANDLING, AND STORAGE

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 90 degrees F or less than 40 degrees F.

1.7 DEFINITIONS

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

1.8 WARRANTY

- A. Warranty sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction," FAR Clause 52.246-21, except that warranty period shall be extended to 2 years.
- B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
- C509-06.....Elastomeric Cellular Preformed Gasket and
Sealing Material
 - C612-10.....Mineral Fiber Block and Board Thermal
Insulation
 - C717-10.....Standard Terminology of Building Seals and
Sealants
 - C834-10.....Latex Sealants
 - C919-08.....Use of Sealants in Acoustical Applications
 - C920-10.....Elastomeric Joint Sealants
 - C1021-08.....Laboratories Engaged in Testing of Building
Sealants
 - C1193-09.....Standard Guide for Use of Joint Sealants
 - C1330-02 (R2007).....Cylindrical Sealant Backing for Use with Cold
Liquid Applied Sealants
 - D1056-07.....Specification for Flexible Cellular Materials—
Sponge or Expanded Rubber
 - E84-09.....Surface Burning Characteristics of Building
Materials
- C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS

- A. S-1:
1. ASTM C920, polyurethane or polysulfide.
 2. Type M.
 3. Class 25.
 4. Grade NS.
 5. Shore A hardness of 20-40.
- B. S-2:
1. ASTM C920, polyurethane or polysulfide.
 2. Type M.
 3. Class 25.

4. Grade P.

5. Shore A hardness of 25-40.

C. S-3:

1. ASTM C920, polyurethane or polysulfide.

2. Type S.

3. Class 25, joint movement range of plus or minus 50 percent.

4. Grade NS.

5. Shore A hardness of 15-25.

6. Minimum elongation of 700 percent.

D. S-4:

1. ASTM C920 polyurethane or polysulfide.

2. Type S.

3. Class 25.

4. Grade NS.

5. Shore A hardness of 25-40.

E. S-5:

1. ASTM C920, polyurethane or polysulfide.

2. Type S.

3. Class 25.

4. Grade P.

5. Shore hardness of 15-45.

F. S-6:

1. ASTM C920, silicone, neutral cure.

2. Type S.

3. Class: Joint movement range of plus 100 percent to minus 50 percent.

4. Grade NS.

5. Shore A hardness of 15-20.

6. Minimum elongation of 1,200 percent.

G. S-7:

1. ASTM C920, silicone, neutral cure.

2. Type S.

3. Class 25.

4. Grade NS.

5. Shore A hardness of 25-30.

6. Structural glazing application.

H. S-8:

1. ASTM C920, silicone, acetoxo cure.

2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

I. S-9:

1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Non-yellowing, mildew-resistant.

2.2 CAULKING COMPOUND

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One-component acoustical caulking, non-drying, non-hardening, synthetic rubber.

2.3 COLOR

- A. Sealants used with exposed masonry shall match color of mortar joints.
- B. Sealants used with unpainted concrete shall match color of adjacent concrete.
- C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
- D. Caulking shall be light gray or white, unless specified otherwise.

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 degrees F. Provide products with low-compression set and of size and

shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 FILLER

- A. Mineral Fiber Board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

2.6 PRIMER

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain-free type.

2.7 CLEANERS - NONPOROUS SURFACES

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material free of oily residues and other substances capable of staining or harming joint substrates and adjacent nonporous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.

2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three-sided adhesion of sealants.

3.3 BACKING INSTALLATION:

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 1/8-inch for sealant depths specified.

E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

F. Take all necessary steps to prevent three-sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY

A. At widths up to 1/4-inch, sealant depth equal to width.

B. At widths over 1/4-inch, sealant depth 1/2 of width up to 1/2-inch maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION

A. General:

1. Apply sealants and caulking only when ambient temperature is between 40 degrees and 100 degrees F.
2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound, and finish compound smooth.
7. Tool joints to concave surface unless shown or specified otherwise.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.

1. Apply a 1/4-inch-minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.

2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition Intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 1/4-inch bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.7 CLEANING

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

3.8 LOCATIONS

- A. Sanitary Joints:
 1. Walls to Plumbing Fixtures: Type S-9.
 2. Counter Tops to Walls: Type S-9.
 3. Pipe Penetrations: Type S-9.
- B. High-Temperature Joints over 400 degrees F:
 1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8.
- C. Interior Caulking:
 1. Typical Narrow Joint 1/4-inch or less at Walls and Adjacent Components: Types C-1 and C-2.
 2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1 and C-2.
 3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1 and C-2.
 4. Perimeter of Lead-Faced Control Windows and Plaster or Gypsum Wallboard Walls: Types C-1 and C-2.
 5. Exposed Isolation Joints at Top of Full-Height Walls: Types C-1 and C-2.
 6. Exposed Acoustical Joint at Sound-Rated Partitions Type C-2.

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7. Concealed Acoustic Sealant: Types S-4, C-1 and C-2.

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**SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies steel doors, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

1.2 RELATED WORK

- A. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- B. Glazing: Section 08 80 00, GLAZING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
 - 1. Fire-rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements.
 - 2. Sound-rated doors, including test report from Testing Laboratory.

1.5 SHIPMENT

- A. Prior to shipment, label each door and frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

1.6 STORAGE AND HANDLING

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Door and Hardware Institute (DHI):
 - A115 Series.....Steel Door and Frame Preparation for Hardware,
Series A115.1 through A115.17 (Dates Vary)
- C. Steel Door Institute (SDI):
 - 113-01 (R2006).....Thermal Transmittance of Steel Door and Frame
Assemblies

128-09.....Acoustical Performance for Steel Door and Frame
Assemblies

D. American National Standard Institute:

A250.8-2003 (R2008).....Specifications for Standard Steel Doors and
Frames

E. American Society for Testing and Materials (ASTM):

A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet, and Strip

A568/568-M-11.....Steel, Sheet, Carbon, and High-Strength, Low-
alloy, Hot-Rolled and Cold-Rolled

A1008-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural,
High-Strength, Low-Alloy and High-Strength,
Low-Alloy with Improved Formability

D1621-10.....Compressive Properties of Rigid Cellular
Plastics

E90-09.....Laboratory Measurement of Airborne Sound
Transmission Loss of Building Partitions

F. The National Association Architectural Metal Manufacturers (NAAMM):
Metal Finishes Manual (AMP 500-06)

G. National Fire Protection Association (NFPA):

80-13.....Fire Doors and Fire Windows

H. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory

I. Factory Mutual System (FM):

Approval Guide

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.

B. Anchors, Fastenings and Accessories: Fastenings anchors, clips
connecting members and sleeves from zinc coated steel.

C. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

2.2 FABRICATION GENERAL

A. GENERAL:

1. Follow ANSI A250.8 for fabrication of standard steel doors, except
as specified otherwise. Doors to receive hardware specified in
Section 08 71 00, DOOR HARDWARE. Tolerances as per ANSI A250.8.
Thickness, 1-3/4 inches, unless otherwise shown.

2. Close top edge of exterior doors flush and seal to prevent water intrusion.
3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.
- B. Standard-Duty Doors: ANSI A250.8, Level 1, full-flush seamless design of size and design shown. Use for interior locations only. Do not use for stairwell doors, security doors and detention doors.
- C. Heavy-Duty Doors: ANSI A250.8, Level 2, full-flush seamless design of size and design shown. Core Construction Types A, D, or F, for interior doors, and, Types B, C, E, or F, for exterior doors.
- D. Custom Metal Hollow Doors: Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design, materials, construction, gages and finish shall be as specified for of standard steel doors.

2.3 METAL FRAMES

- A. General:
 1. ANSI A250.8, 0.053-inch-thick sheet steel, types and styles as shown or scheduled.
 2. Frames for exterior doors: Fabricate from 0.067-inch-thick galvanized steel conforming to ASTM A525.
 3. Frames for labeled fire rated doors.
 - a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc. or Factory Mutual.
 - b. Fire-rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements.
Provide labels of metal or engraved stamp, with raised or incised markings.
 4. Knocked-down frames are not acceptable.
- B. Reinforcement and Covers:
 1. ANSI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
 2. Provide mortar guards securely fastened to back of hardware reinforcements.
- C. Terminated Stops: ANSI A250.8. Stops shall be terminated 6 inches above finished floor, cut at a 45-degree angle, and capped with a steel welded plate of the same gage as the door frame.

D. Glazed Openings:

- a. Integral stop on exterior, corridor, or secure side of door.
- b. Design rabbet width and depth to receive glazing material or panel shown or specified.

E. Frame Anchors:

1. Floor Anchors:

- a. Where floor fills occur, provide extension type floor anchors to compensate for depth of fill.
- b. At bottom of jamb use 0.053-inch-thick steel clip angles welded to jamb and drilled to receive two 1/4-inch floor bolts.
- c. Where mullions occur, provide 0.093-inch-thick steel channel anchors, drilled for two 1/4-inch floor bolts and frame anchor screws.

2. Jamb Anchors:

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 24 inches apart, except for fire-rated frames space anchors as required by labeling authority.
- b. Form jamb anchors of not less than 0.042-inch-thick steel unless otherwise specified.
- c. Anchors for Stud Partitions: Either weld to frame or use lock-in, snap-in type. Provide tabs for securing anchor to the sides of the studs.
- d. Anchors for Frames Set in Prepared Openings:
 - 1) Steel pipe spacers with 1/4-inch inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 2 inches wide, welded to jamb near stop.
 - 2) Drill jamb stop and strap spacers for 1/4-inch flat head bolts to pass through frame and spacers.
- e. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

2.4 SHOP PAINTING

- A. ANSI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Plumb, align and brace frames securely until permanent anchors are set.
1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.

2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
3. Protect frame from accidental abuse.
4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.

B. Floor Anchors:

1. Anchor the bottom of door frames to floor with two 1/4-inch-diameter expansion bolts.
2. Power-actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:

1. Secure anchors to sides of studs with 2 fasteners through anchor tabs. Use steel drill screws to steel studs.
2. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 1/4-inch expansion bolts through spacers. Where subframes or rough bucks are used, 1/4-inch expansion bolts on 24-inch centers or power-activated drive pins 24 inches on centers.

- D. Install anchors for labeled fire-rated doors to provide rating as required.

3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE

- A. Install doors and hardware as specified herein and in Section 08 14 00, WOOD DOORS and Section 08 71 00, DOOR HARDWARE.

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SECTION 08 14 00
INTERIOR WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies interior flush doors with plastic-laminate faces.
- B. Section includes fire-rated doors, sound-retardant doors, and smoke doors.

1.2 RELATED WORK

- A. Metal Door Frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- B. Doors and frames of a forced entry/ballistic resistant rated: Section 08 34 53, SECURITY DOORS AND FRAMES.
- C. Door Hardware Including Hardware Location (Height): Section 08 71 00, DOOR HARDWARE.
- D. Installation of Doors and Hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 14 00, WOOD DOORS, or Section 08 71 00, DOOR HARDWARE.
- E. Glazing: Section 08 80 00, GLAZING.
- F. Finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- G. Card Readers and Biometric Devices: Section 28 13 00, ACCESS CONTROL.
- H. Intrusion Alarm: Section 28 16 11, INTRUSION DETECTION SYSTEM.
- I. Security Monitors: Section 28 51 00, SECURITY CONTROL CENTER.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Corner section of flush plastic-laminate face door 12-inches square, showing details of construction, labeled to show grade and type number and conformance to specified standard.
 - 2. Plastic-laminate sample 8 inches by 11 inches by 1/4-inch showing specified color and finish.
- C. Shop Drawings:
 - 1. Show every door in Project and schedule location in building.
 - 2. Indicate type, grade, finish and size; include detail of glazing, sound gasketing, and pertinent details.
 - 3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.

D. Manufacturer's Literature and Data:

1. Sound-rated doors, including test report indicating STC rating per ASTM E90 from test laboratory.
2. Labeled fire-rated doors showing conformance with NFPA 80.

E. Laboratory Test Reports:

1. Screw-holding capacity test report in accordance with WDMA T.M.10.
2. Split-resistance test report in accordance with WDMA T.M.5.
3. Cycle/Slam test report in accordance with WDMA T.M.7.
4. Hinge-loading test report in accordance with WDMA T.M.8.

1.4 WARRANTY

- A. Doors are subject to terms of Article titled "Warranty of Construction," FAR Clause 52.246-21, except that warranty shall be as follows:
1. For interior doors, manufacturer's warranty for lifetime of original installation.
 2. Specified STC RATING for sound-retardant rated door assembly in place.

1.5 DELIVERY AND STORAGE

- A. Factory seal doors and accessories in minimum of 6-mil polyethylene bags or cardboard packages which shall remain unbroken during delivery and storage.
- B. Store in accordance with WDMA I.S.1-A, Jobsite Information.
- C. Label package for door opening where used.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to extent referenced. Publications are referenced in text by basic designation only.
- B. Window and Door Manufacturers Association (WDMA):
- I.S.1A-11.....Architectural Wood Flush Doors
- I.S.4-09.....Water-Repellent Preservative Non-Pressure
Treatment for Millwork
- I.S.6A-11.....Architectural Wood Stile and Rail Doors
- T.M.6-08.....Adhesive (Glue Bond) Durability Test Method
- T.M.7-08.....Cycle-Slam Test Method
- T.M.8-08.....Hinge-Loading Test Method
- T.M.10-08.....Screw-Holding Test Method

- C. National Fire Protection Association (NFPA):
 - 80-10.....Protection of Buildings from Exterior Fire
 - 252-08.....Fire Tests of Door Assemblies
- D. ASTM International (ASTM):
 - E90-09.....Laboratory Measurements of Airborne Sound
Transmission Loss

PART 2 - PRODUCTS

2.1 FLUSH DOORS

- A. General:
 - 1. Meet requirements of WDMA I.S.1-A, Extra Heavy Duty.
 - 2. Adhesive: Type II.
 - 3. Thickness: 1-3/4 inches unless otherwise shown or specified.
- B. Plastic-Laminate-Faced Doors:
 - 1. Interior Solid-Core Doors (SC):
 - a. Grade: Custom.
 - b. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD3, Grade HGS.
 - c. Color, Patterns, and Finishes: As indicated on the Drawings.
 - d. Exposed Vertical Edges: Plastic laminate that matches faces, applied before faces.
 - e. Core: Particleboard.
 - f. Construction: Three plies. Stiles and rails are bonded to core, and then entire unit is abrasive planed before faces are applied. Faces are bonded to core using a hot press.
 - 2. Glazing: On non-labeled doors, use applied wood stops nailed tight on room side and attached on opposite side with flathead, countersunk wood screws, spaced approximately 5 inches on centers.
- C. Stiles and Rails:
 - 1. Option for Wood Stiles and Rails: Composite material having screw withdrawal force greater than minimum performance level value when tested in accordance with WDMA T.M.10.
 - 2. Provide adequate blocking for bottom of doors having mechanically operated door bottom seal meeting or exceeding the performance duty level per T.M.10 for horizontal door edge screw holding.

D. Fire-Rated Wood Doors:

1. Fire Performance Rating: Furnish doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated on the Drawings.
2. Labels:
 - a. Doors shall conform to the requirements of ASTM E2074, or NFPA 252, and, carry an identifying label from a qualified testing and inspection agency for class of door or opening shown designating fire performance rating.
 - b. Metal labels with raised or incised markings.
3. Performance Criteria for Stiles of doors utilizing standard mortise leaf hinges:
 - a. Hinge Loading: WDMA T.M.8. Average of 10 test samples for extra-heavy-duty doors.
 - b. Direct Screw Withdrawal: WDMA T.M.10 for extra-heavy-duty doors. Average of 10 test samples using a steel, fully threaded No. 12 wood screw.
 - c. Cycle Slam: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with WDMA T.M.7.
4. Additional Hardware Reinforcement:
 - a. Provide fire-rated doors with hardware reinforcement blocking.
 - b. Size of lock blocks as required to secure hardware specified.
 - c. Top, bottom and intermediate rail blocks shall measure not less than 5 inches minimum by full core width.
 - d. Reinforcement blocking in compliance with manufacturer's labeling requirements.
 - e. Mineral material similar to core is not acceptable.
5. Other Core Components: Manufacturer's standard as allowed by the labeling requirements.
6. Provide steel frame approved for use in labeled doors for vision panels.
7. Provide steel astragal on pair of doors.

E. Smoke Barrier Doors:

1. For glazed openings use steel frames approved for use in labeled doors.

2. Provide a steel astragal on one leaf of pairs of doors, including double egress doors.

F. Sound-Rated Doors:

1. Fabricated as specified for flush wood doors with additional construction requirements to meet specified sound transmission class (STC).
2. STC Rating of the door assembly in place when tested in accordance with ASTM E90 by an independent nationally recognized acoustical testing laboratory not less than 36.
3. Accessories:
 - a. Frame Gaskets: Continuous closed-cell sponge neoprene with stop adjusters.
 - b. Automatic Door Bottom Seal:
 - 1) Steel spring operated, closed-cell sponge neoprene metal mounted removable in extruded aluminum housing with a medium matte 4.0 mil thick clear anodized finish.
 - 2) Concealed or surface-mounted.

2.2 PREFINISH, PREFIT OPTION

- A. Flush doors may be factory machined to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.
- B. Factory fitting to conform to Specification for shop and field fitting, including factory application of sealer to edge and routings.

2.3 IDENTIFICATION MARK

- A. On top edge of door.
- B. Either a stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, code date of manufacture and quality.
- C. Accompanied by either of the following additional requirements:
 1. An identification mark or a separate certification including name of inspection organization.
 2. Identification of standards for door, including glue type.
 3. Identification of plastic-laminate face and quality certification.

2.4 SEALING

- A. Give top and bottom edge of doors 2 coats of catalyzed polyurethane or water-resistant sealer before sealing in shipping containers.

PART 3 - EXECUTION

3.1 DOOR PREPARATION

- A. Field, shop or factory preparation: Do not violate the qualified testing and inspection agency label requirements for fire-rated doors.
- B. Clearances between Doors and Frames and Floors:
 - 1. Maximum 1/8-inch clearance at the jambs, heads, and meeting stiles, and a 3/4-inch clearance at bottom, except as otherwise specified.
 - 2. Maximum clearance at bottom of sound rated doors, light-proofed doors, doors to operating rooms, and doors designated to be fitted with mechanical seal: 3/8-inch.
- C. Provide cutouts for special details required and specified.
- D. Route doors for hardware using templates and location heights specified in Section, 08 71 00 DOOR HARDWARE.
- E. Fit doors to frame, bevel lock edge of doors 1/8-inch for each 2 inches of door thickness undercut where shown.
- F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water-resistant sealer.
- G. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.
- H. Apply a steel astragal on the opposite side of active door on pairs of fire-rated doors.
- I. Apply a steel astragal to meeting style of active leaf of pair of doors or double egress smoke doors.

3.2 INSTALLATION OF DOORS APPLICATION OF HARDWARE

- A. Install doors and hardware as specified in this Section.

3.3 DOOR PROTECTION

- A. As door installation is completed, place polyethylene bag or cardboard shipping container over door and tape in place.
- B. Provide protective covering over knobs and handles in addition to covering door.
- C. Maintain covering in good condition until removal is approved by COR.

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SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies access doors or panels.

1.2 RELATED WORK

- A. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.
B. Access Doors in Acoustical Ceilings: Section 09 51 00, ACOUSTICAL
CEILINGS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT
DATA, AND SAMPLES.
B. Shop Drawings: Access doors, each type, showing construction, location
and installation details.
C. Manufacturer's Literature and Data: Access doors, each type.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to extent
referenced. Publications are referenced in the text by basic
designation only.
B. American Society for Testing and Materials (ASTM):
A167-99(R-2009).....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet and Strip
A1008-10.....Steel Sheet, Cold-Rolled, Carbon, Structural,
High-Strength Low-Alloy
C. American Welding Society (AWS):
D1.3-08.....Structural Welding Code Sheet Steel
D. National Fire Protection Association (NFPA):
80-10.....Fire Doors and Windows
E. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual
F. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory

PART 2 - PRODUCTS

2.1 FABRICATION, GENERAL

- A. Fabricate components to be straight, square, flat and in same plane
where required.

1. Slightly round, exposed edges and without burrs, snags and sharp edges.
 2. Exposed welds continuous and ground smooth.
 3. Weld in accordance with AWS D1.3.
- B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame. For fire-rated doors, use hinges and locks as required by fire test.
- C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on 4 sides to secure access door in opening. Provide anchors as required by fire test.

2.2 ACCESS DOORS, FIRE-RATED

- A. Shall meet requirements for "B" label 1-1/2 hours with maximum temperature rise of 250 degrees F.
- B. Comply with NFPA 80 and have Underwriters Laboratories Inc., or other nationally recognized laboratory label for Class B opening.
- C. Door Panel: Form of 0.0359-inch-thick steel sheet, insulated sandwich-type construction.
- D. Frame: Form of 0.0598-inch-thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide frame flange at perimeter where installed in concrete masonry or gypsum board openings.
1. Weld exposed joints in flange and grind smooth.
 2. Provide frame flange at perimeter where installed in concrete masonry or gypsum board.
- E. Automatic Closing Device: Provide automatic closing device for door.
- F. Hinge: Continuous steel hinge with stainless-steel pin.
- G. Lock:
1. Self-latching, with provision for fitting flush a standard screw-in type lock cylinder. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
 2. Provide latch release device operable from inside of door. Mortise case in door.

2.3 ACCESS DOORS, FLUSH PANEL

- A. Door Panel:
1. Form of 0.0747-inch-thick steel sheet.
 2. Reinforce to maintain flat surface.

B. Frame:

1. Form of 0.0598-inch-thick steel sheet of depth and configuration to suit material and type of construction where installed.
2. Provide surface-mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
3. Weld exposed joints in flange and grind smooth.

C. Hinge:

1. Concealed spring hinge to allow panel to open 175 degrees.
2. Provide removable hinge pin to allow removal of panel from frame.

D. Lock:

1. Flush, screwdriver-operated cam lock.
2. Provide tamper-proof screws (spanner head locks).

2.4 FINISH

- A. Provide in accordance with NAAMM AMP 500 Series on exposed surfaces.
- B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.

2.5 SIZE

- A. Minimum 24-inch-square door unless otherwise shown or required.

PART 3 - EXECUTION

3.1 LOCATION

- A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.
- B. Use fire-rated doors in fire-rated partitions and ceilings.
- C. Use flush panels in partitions and gypsum board or plaster ceilings.

3.2 INSTALLATION, GENERAL

- A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.
- B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.
- C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.

3.3 ANCHORAGE

- A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.

- B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.
- C. Anchors for fire-rated access doors shall meet requirements of applicable fire test.

3.4 ADJUSTMENT

- A. Adjust hardware so that door panel will open freely.
- B. Adjust door when closed so door panel is centered in the frame.

- - - E N D - - -

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Door hardware and related items necessary for complete installation and operation of doors.

1.2 RELATED WORK

- A. Caulking: Section 07 92 00, JOINT SEALANTS.
- B. Application of Hardware: Section 08 14 00, WOOD DOORS; Section 08 11 13, HOLLOW METAL DOORS AND FRAMES; Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- C. Painting: Section 09 91 00, PAINTING.
- D. Card Readers: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.
- E. Electrical: Division 26, ELECTRICAL.
- F. Fire Detection: Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 GENERAL

- A. All hardware shall comply with Uniform Federal Accessible Standards (UFAS), unless specified otherwise.
- B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).
- C. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.
- D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.
- E. The following items shall be of the same manufacturer, except as otherwise specified:
 - 1. Mortise locksets.
 - 2. Hinges for hollow metal and wood doors.
 - 3. Surface applied overhead door closers.
 - 4. Exit devices.

5. Floor closers.

1.4 WARRANTY

- A. Automatic door operators shall be subject to the terms of FAR Clause 52.246-21, except that the warranty period shall be 2 years in lieu of 1 year for all items except as noted below:
1. Locks, Latchsets, and Panic Hardware: 5 years.
 2. Door Closers and Continuous Hinges: 10 years.

1.5 MAINTENANCE MANUALS

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS," furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

1.6 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23. Submit 2 final copies of the final approved schedules to VAMC Locksmith as record copies (VISN Locksmith if the VAMC does not have a locksmith).
- B. Hardware Schedule: Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

- C. Samples and Manufacturers' Literature:

1. Samples: All hardware items (proposed for the Project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and Project number.
2. Samples are not required for hardware listed in the Specifications by manufacturer's catalog number, if the Contractor proposes to use the manufacturer's product specified.

- D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within 4 years of submittal of reports for approval.

1.7 DELIVERY AND MARKING

- A. Deliver items of hardware to jobsite in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to Contracting Officer's Representative (COR) for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in Project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the Project.

1.8 PREINSTALLATION MEETING

- A. Convene a preinstallation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this Section, including Contractor and Installer, Architect, Project Engineer and VA Locksmith, Hardware Consultant, and Hardware Manufacturer's Representative. Review the following:
1. Inspection of door hardware.
 2. Job and surface readiness.
 3. Coordination with other work.
 4. Protection of hardware surfaces.
 5. Substrate surface protection.
 6. Installation.
 7. Adjusting.
 8. Repair.
 9. Field quality control.
 10. Cleaning.

1.9 INSTRUCTIONS

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mates, thresholds and the like specified herein, hardware requirements for each door are indicated on Drawings by symbols.

Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.

B. Keying:

1. All cylinders shall be keyed into existing Great Grand Master Key System. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 7-pin type. Keying information shall be furnished at a later date by the COR.
2. Keying will be accomplished by the VA's locksmith. Contractor shall remove construction cores at the end of the Project and furnish new Project removable cores, properly labeled for VA use.

1.10 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.
- B. American Society for Testing and Materials (ASTM):
- F883-04.....Padlocks
 - E2180-07.....Standard Test Method for Determining the
Activity of Incorporated Antimicrobial Agent(s)
In Polymeric or Hydrophobic Materials
- C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
- A156.1-06.....Butts and Hinges
 - A156.2-03.....Bored and Pre-assembled Locks and Latches
 - A156.3-08.....Exit Devices, Coordinators, and Auto Flush
Bolts
 - A156.4-08.....Door Controls (Closers)
 - A156.5-01.....Auxiliary Locks and Associated Products
 - A156.6-05.....Architectural Door Trim
 - A156.8-05.....Door Controls-Overhead Stops and Holders
 - A156.12-05Interconnected Locks and Latches
 - A156.13-05.....Mortise Locks and Latches Series 1000
 - A156.14-07Sliding and Folding Door Hardware

- A156.15-06.....Release Devices-Closer Holder, Electromagnetic
and Electromechanical
- A156.16-08.....Auxiliary Hardware
- A156.17-04Self-Closing Hinges and Pivots
- A156.18-06.....Materials and Finishes
- A156.20-06Strap and Tee Hinges, and Hasps
- A156.21-09.....Thresholds
- A156.22-05.....Door Gasketing and Edge Seal Systems
- A156.23-04.....Electromagnetic Locks
- A156.24-03.....Delayed Egress Locking Systems
- A156.25-07Electrified Locking Devices
- A156.26-06.....Continuous Hinges
- A156.28-07Master Keying Systems
- A156.29-07Exit Locks and Alarms
- A156.30-03High Security Cylinders
- A156.31-07Electric Strikes and Frame Mounted Actuators
- A250.8-03.....Standard Steel Doors and Frames
- D. National Fire Protection Association (NFPA):
 - 80-10.....Fire Doors and Fire Windows
 - 101-09.....Life Safety Code
- E. Underwriters Laboratories, Inc. (UL):
 - Building Materials Directory (2008)

PART 2 - PRODUCTS

2.1 BUTT HINGES

- A. ANSI A156.1. Provide only 3-knuckle hinges, except 5-knuckle where the required hinge type is not available in a 3-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:
 - 1. Exterior Doors: Type A2112/A5112 for doors 3 feet wide or less and Type A2111/A5111 for doors over 3 feet wide. Hinges for exterior outswing doors shall have non-removable pins. Hinges for exterior fire-rated doors shall be of stainless-steel material.
 - 2. Interior Doors: Type A8112/A5112 for doors 3 feet wide or less and Type A8111/A5111 for doors over 3 feet wide. Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc.) shall be of stainless-steel material.

B. Provide quantity and size of hinges per door leaf as follows:

1. Doors Up to 4 Feet High: 2 hinges.
2. Doors 4 Feet to 7 Feet 5 Inches High: 3 hinges minimum.
3. Doors Greater than 7 Feet 5 Inches High: 4 hinges.
4. Doors Up to 3 Feet Wide, Standard Weight: 4-1/2-inch by 4-1/2-inch hinges.
5. Doors Over 3 Feet to 3 Feet 6 Inches Wide, Standard Weight: 5 inches by 4-1/2 inches.
6. Doors Over 3 Feet 6 Inches to 4 Feet, Heavy Weight: 5 inches by 4-1/2 inches.
7. Provide heavy-weight hinges where specified.
8. At doors weighing 150 lbs. or more, furnish 5-inch-high hinges.

C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

2.2 CONTINUOUS HINGES

A. ANSI/BHMA A156.26, Grade 1-600.

1. Listed under Category N in BHMA's "Certified Product Directory."

B. General: Minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete

C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 0.25-inch minimum diameter pin that extends entire length of hinge.

1. Base Metal for Exterior Hinges: Stainless steel.
2. Base Metal for Interior Hinges: Steel.
3. Base Metal for Hinges for Fire-Rated Assemblies: Steel.
4. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
5. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
6. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer's adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.

2.3 DOOR CLOSING DEVICES

- A. Closing devices shall be products of one manufacturer.

2.4 OVERHEAD CLOSERS

- A. Conform to ANSI A156.4, Grade 1.
- B. Closers shall conform to the following:
1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
 2. Where specified, closer shall have hold-open feature.
 3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
 4. Material of closer body shall be forged or cast.
 5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
 6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless-steel material.
 7. Closers shall have full-size metal cover; plastic covers will not be accepted.
 8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
 9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
 10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
 11. Provide parallel arm closers with heavy-duty rigid arm.

12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
14. All closers shall have a 1½-inch minimum piston diameter.

2.5 FLOOR CLOSERS AND FLOOR PIVOT SETS

- A. Comply with ANSI A156.4. Provide stainless-steel floor plates for floor closers and floor pivots, except where metal thresholds occur. Provide cement case for all floor closers. Floor closers specified for fire doors shall comply with Underwriters Laboratories, Inc., requirements for concealed type floor closers for classes of fire doors indicated on Drawings. Hold-open mechanism, where required, shall engage when door is opened 105 degrees, except when door swing is limited by building construction or equipment, the hold-open feature shall engage when door is opened approximately 90 degrees. The hold-open mechanism shall be selectable on/off by turning a screw through the floor plate. Floor closers shall have adjustable hydraulic back-check, adjustable close speed, and adjustable latch speed. Provide closers with delayed action where a hold-open mechanism is not required. Floor closers shall be multi-sized. Single-acting floor closers shall also have built-in dead stop. Where required, provide closers with special cement cases appropriate for shallow deck installation or where concrete joint lines run through the floor blockout. At offset-hung doors installed in deep reveals, provide special closer arm and spindle to allow for installation. Where stone or terrazzo is applied over the floor closer case, provide closer without floor plate and with extended spindle (length as required) and special cover pan (depth as required) to allow closer to be accessed without damaging the material applied over the closer. Pivots for non-labeled doors shall be cast, forged or extruded brass or bronze.
- B. Where floor closer appears in hardware set provide the following as applicable.
 1. Double-Acting Floor Closers: Type C06012.
 2. Single-Acting Floor Closer: Type C06021 (center pivoted).
(Intermediate pivot is not required.)
 3. Single-Acting Floor Closers: Type C06041 (offset pivoted).

4. Single-Acting Floor Closer for Labeled Fire Doors: Type C06051
(offset pivoted).
5. Single-Acting Floor Closers for Lead-Lined Doors: Type C06071
(offset pivoted).

2.6 DOOR STOPS

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Provide floor stops (Type L02141 or L02161 in office areas; Type L02121 x 3 screws into floor elsewhere). Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4 inches of the wall face and impact the door within the leading half of its width.
- E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.
- F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 3-inch core-drilled hole and filled with quick-setting cement.
- G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.
- H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where 2 doors would interfere with each other in swinging.
- I. Provide appropriate door-mounted stop on doors in individual toilets where floor- or wall-mounted stops cannot be used.
- J. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4 inches of the wall.
- K. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

2.7 OVERHEAD DOOR STOPS AND HOLDERS

- A. Conform to ANSI Standard A156.8. Overhead holders shall be of sizes recommended by holder manufacturer for each width of door. Set overhead holders for 110-degree opening, unless limited by building construction or equipment. Provide Grade 1 overhead concealed slide type: stop-only at rated doors and security doors, hold-open type with exposed hold-open on/off control at all other doors requiring overhead door stops.

2.8 FLOOR DOOR HOLDERS

- A. Conform to ANSI Standard A156.16. Provide extension strikes for Types L01301 and L01311 holders where necessary.

2.9 LOCKS AND LATCHES

- A. Basis of Design: Provide locks and latches by Yale Locks & Hardware, 225 Episcopal Road, Berlin, CT 06037-4004, telephone 800-438-1951, fax 800-338-0965, www.yalelocks.com.
 - 1. 8800 Series, Grade 1, mortise locks.
 - 2. Cylindrical locksets, Grade 1, of series as applicable to indicated door functions per Door Hardware Schedule.
 - 3. Hardware Trim: Carmel - CRR.
- B. Conform to ANSI A156.2. Locks and latches for doors 1-3/4 inches thick or over shall have beveled fronts. Lock cylinders shall have not less than 7 pins. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 3/4-inch throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores.
- C. In addition to above requirements, locks and latches shall comply with following requirements:
 - 1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be Yale Series 8800, Grade 1. All locksets and latchsets shall have lever handles fabricated from cast stainless

- steel. Provide sectional (lever x rose) lever design matching. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 4-7/8-inch curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 7/8-inch lip-to-center dimension. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on both sides of the opening, provide non-ferrous mortise lock case.
2. Cylindrical Lock and Latch Sets: Levers shall meet Americans with Disabilities Act (ADA) requirements. Cylindrical locksets shall be Series 4000 Grade I. All locks and latchsets shall be furnished with 4-7/8-inch curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 7/8-inch lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design. Where 2 turn pieces are specified for Lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)
 3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.5.
 4. Privacy locks in non-mental-health patient rooms shall have an inside thumbturn for privacy and an outside thumbturn for emergency entrance. Single-occupancy patient privacy doors shall typically swing out; where such doors cannot swing out, provide center-pivoted doors with rescue hardware (see HW-2B).

2.10 PUSH-BUTTON COMBINATION LOCKS

- A. ANSI/BHMA A156.13, Grade 1. Battery operated pushbutton entry.
- B. Construction: Heavy-duty mortise lock housing conforming to ANSI/BHMA A156.13, Grade 1. Lever handles and operating components in compliance with the UFAS and the ADA Accessibility Guidelines. Match lever handles of locks and latchsets on adjacent doors.

- C. Special Features: Key override to permit a master keyed security system and a pushbutton security code activated passage feature to allow access without using the entry code.

2.11 ELECTROMAGNETIC LOCKS

- A. ANSI/BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door. Listed under Category E in BHMA's "Certified Product Directory."
1. Type: Full exterior or full interior, as required by application indicated.
 2. Strength Ranking: 1,000 lbf.
 3. Inductive Kickback Peak Voltage: Not more than 53V.
 4. Residual Magnetism: Not more than 4 lbf to separate door from magnet.
- B. Delayed-Egress Locks: BHMA A156.24. Listed under Category G in BHMA's "Certified Product Directory."
1. Means of Egress Doors: Lock releases within 15 seconds after applying a force not more than 15 lbf for not more than 3 seconds, as required by NFPA 101.
 2. Security Grade: Activated from secure side of door by initiating device.
 3. Movement Grade: Activated by door movement as initiating device.
 4. The lock housing shall not project more than 4 inches from the underside of the frame head stop.

2.12 ELECTRIC STRIKES

- A. ANSI/BHMA A156.31 Grade 1.
- B. General: Use fail-secure electric strikes at fire-rated doors.

2.13 KEYS

- A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	Quantity
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each

Great Grand Master set	5 keys
Control key	2 keys

2.14 KEY CABINET

- A. ANSI Standard A156.5. Provide key cabinet made of cold-rolled, 0.0478-inch-thick furniture steel electro-welded. Doors shall have "no sag" continuous brass-pin piano-type hinge and be equipped with chrome-plated locking door handles, hook cam and mechanical push-button door lock. Key Cabinet and Key Control System shall accommodate all keys for this Project plus 25 percent. Provide minimum number of multiple cabinets where a single cabinet of largest size will not accommodate the required number of keys.
- B. Key tags shall consist of 2 sets: Permanent self-locking and loan key snaphook type with tag colors as follows: Red fiber marker of the permanent self-locking type approximately 1-1/4 inches in diameter engraved with the legend "FILE KEY MUST NOT BE LOANED." Also furnish for each hook a white cloverleaf key marker with snap-hooks engraved with the legend "LOAN KEY."
- C. The manufacturer of the lock cylinders and locks shall attach a key tag to keys of each lock cylinder and shall mark thereon the respective item number and key change number. Provide each group of keys in a key gathering envelope (supplied by Key Cabinet Manufacturer) in which the lock manufacturer shall include the following information: Item number, key change number and door number. The Contractor shall furnish the Key Cabinet Manufacturer the hardware and keying schedules and change keys.
- D. The Key Cabinet Manufacturer shall set up a 3-way cross index system, including master keys, listing the keys alphabetically, the hooks numerically and the key changes numerically on different colored index cards. Index cards shall be typewritten and inserted in a durable binder. Attach the keys to the 2 sets of numbered tags supplied with the cabinet. (The permanent tag and the loan key tag.) Instruct the Owner in proper use of the system. Install cabinet as directed by the COR.

2.15 ARMOR PLATES, KICK PLATES, MOP PLATES AND DOOR EDGING

- A. Conform to ANSI Standard A156.6.
- B. Provide protective plates and door edging as specified below:
 1. Kick plates, mop plates and armor plates of metal, Type J100 series.

2. Provide kick plates and mop plates where specified. Kick plates shall be 10 inches or 12 inches high. Mop plates shall be 6 inches high. Both kick and mop plates shall be minimum 0.050-inch thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 1-1/2 inches less than width of door, except pairs of metal doors which shall have plates 1 inch less than width of each door. Extend all other kick and mop plates to within 1/4-inch of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see Specification Sections pertaining to door frames.
3. Kick plates and/or mop plates are not required on following door sides:
 - a. Armor plate side of doors;
 - b. Exterior side of exterior doors;
 - c. Closet side of closet doors;
 - d. Both sides of aluminum entrance doors.
4. Armor plates for doors are listed under Article "Hardware Sets." Armor plates shall be thickness as noted in the hardware set, 35 inches high and 1-1/2 inches less than width of doors, except on pairs of metal doors. Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 1 inch less than width of each door. Where top of intermediate rail of door is less than 35 inches from door bottom, extend armor plates to within 1/2-inch of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 1/2-inch of panic bolt push bar.
5. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick plate in place of armor plate. Size of stretcher plate and kick plate shall be 10 inches high.
6. Provide stainless-steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset

armor front. Forward edge guards to wood door manufacturer for
factory installation on doors.

2.16 EXIT DEVICES

- A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have cast satin stainless-steel lever handles of design similar to locksets, unless otherwise specified. Provide key cylinders for keyed operating trim and, where specified, cylinder dogging.
- B. Surface vertical rod panics shall only be provided less bottom rod; provide fire pins as required by exit device and door fire labels. Do not provide surface vertical rod panics at exterior doors.
- C. Concealed vertical rod panics shall be provided less bottom rod at interior doors, unless lockable or otherwise specified; provide fire pins as required by exit device and door fire labels. Where concealed vertical rod panics are specified at exterior doors, provide with both top and bottom rods.
- D. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.
- E. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.
- F. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for fire exit hardware. Submit proof of compliance.

2.17 FLUSH BOLTS (LEVER EXTENSION)

- A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.
- B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.
- C. Face plates for cylindrical strikes shall be rectangular and not less than 1 inch by 2-1/2 inches.
- D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.
- E. Provide extension rods for top bolt where door height exceeds 7 feet 2 inches.

2.18 FLUSH BOLTS (AUTOMATIC)

- A. Conform to ANSI A156.3. Dimension of flush bolts shall conform to ANSI A115. Bolts shall conform to Underwriters Laboratories, Inc., requirements for fire door hardware. Flush bolts shall automatically latch and unlatch. Furnish dustproof strikes conforming to ANSI A156.16 for bottom flushbolt. Face plates for dustproof strike shall be rectangular and not less than 1-1/2 by 3-1/2 inches.
- B. At interior doors, provide auto flush bolts less bottom bolt, unless otherwise specified, except at wood pairs with fire rating greater than 20 minutes; provide fire pins as required by auto flush bolt and door fire labels.

2.19 DOOR PULLS WITH PLATES

- A. Conform to ANSI A156.6. Pull Type J401, 6 inches high by 3/4-inch diameter with plate Type J302, 3-1/2 inches by 14 inches, unless otherwise specified. Provide pull with projection of 2-3/4 inches and a clearance of 2 inches. Cut plates of door pull plate for cylinders, or turn pieces where required.

2.20 PUSH PLATES

- A. Conform to ANSI A156.6. Metal, Type J302, 8 inches wide by 14 inches high. Provide metal Type J302 plates 4 inches wide by 14 inches high where push plates are specified for doors with stiles less than 8 inches wide. Cut plates for cylinders, and turn pieces where required.

2.21 COMBINATION PUSH AND PULL PLATES

- A. Conform to ANSI 156.6. Type J303, stainless steel 1/8-inch thick, 3-1/3 inches wide by 16 inches high, top and bottom edges shall be rounded. Secure plates to wood doors with 1-1/2-inch-long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

2.22 COORDINATORS

- A. Conform to ANSI A156.16. Coordinators, when specified for fire doors, shall comply with Underwriters Laboratories, Inc., requirements for fire door hardware. Coordinator may be omitted on exterior pairs of doors where either door will close independently regardless of the position of the other door. Coordinator may be omitted on interior pairs of non-labeled open where open back strike is used. Open back strike shall not be used on labeled doors. Paint coordinators to match door frames, unless coordinators are plated. Provide bar type

coordinators, except where gravity coordinators are required at acoustic pairs. For bar type coordinators, provide filler bars for full width and, as required, brackets for push-side, surface-mounted closers, overhead stops, and vertical rod panic strikes.

2.23 THRESHOLDS

- A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless-steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.
- B. For thresholds at elevator entrances, see other Sections of Specifications.
- C. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.
- D. Provide with miter returns where threshold extends more than 0.5inch from fame face.

2.24 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET FOR LIGHT-PROOF OR SOUND-CONTROL DOORS

- A. Conform to ANSI A156.22. Provide mortise or under-door type, except where not practical. For mortise automatic door bottoms, provide type specific for door construction (wood or metal).

2.25 WEATHERSTRIPS (FOR EXTERIOR DOORS)

- A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 cfm per foot of crack length.

2.26 MISCELLANEOUS HARDWARE

- A. Access Doors Including Sheet Metal, Screen and Woven Wire Mesh Types: Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E76213, conforming to ANSI A156.5. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.
- B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur, except as otherwise specified. Provide cylinders to operate locking devices where specified for following partitions and doors:
 - 1. Folding doors and partitions.
 - 2. Slide-up doors.

3. Swing-up doors.
4. Fire-rated access doors-Engineer's key set.
5. Doors from corridor to electromagnetic shielded room.
6. Day gate on vault door.

C. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch-type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

2.27 PADLOCKS FOR VARIOUS DOORS, GATES AND HATCHES

- A. ASTM E883, size 2-inch-wide chain; furnish extended shackles as required by job conditions. Provide padlocks, with key cylinders, for each door in following areas as noted.
- B. Key padlocks as follows:
 1. Constant Temperature and Cold Rooms in Research Departments: Research Laboratory Set.
 2. Refrigerators in Canteen Department: Canteen Storage Set.
 3. All Refrigerator Rooms in Main Kitchen Department: Kitchen Storage Set.
 4. Roof Access and Scuttles: Engineer's set.
- C. Omit padlocks on communicating refrigerator doors.

2.28 THERMOSTATIC TEMPERATURE CONTROL VALVE CABINETS

- A. Where lock is shown, equip each cabinet door (metal) with lock Type E06213, conforming to ANSI A156.5. Key locks in Key Sets approved by COR. See Mechanical Drawings and Specifications for location of cabinets.
- B. Cabinet manufacturer shall supply the hinges, bolts and pulls. Ship locks to cabinet manufacturer for installation.

2.29 HINGED WIRE GUARDS (FOR WINDOWS, DOORS AND TRANSOMS) AND WIRE PARTITION DOORS

- A. Butt hinges, Type A8133 (special swaging) 4 inches by 3-1/2 inches, Finish US2C.
 1. 3 hinges for guards over 3-1/2 feet high.

2. 2 hinges for guards less than 3-1/2 feet high.

B. Conform to ANSI A156.5. Lock Type E06081 for guards and Type E06061 for partitions.

1. Keying: Except as noted otherwise, key locks like entrance door or space wherein guards and partitions are located except as otherwise specified.

2. Key locks for partitions enclosing mechanical and electrical equipment in Engineer's Set. (See detailed Drawings for number of locks and butt hinges required for each guard.)

2.30 FINISHES

A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.

B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.

C. Miscellaneous Finishes:

1. Hinges - Exterior Doors: 626 or 630.

2. Hinges - Interior Doors: 652 or 630.

3. Pivots: Match door trim.

4. Door Closers: Factory applied paint finish. Dull or satin aluminum color.

5. Thresholds: Mill finish aluminum.

6. Cover Plates for Floor Hinges and Pivots: 630.

7. Other Primed Steel Hardware: 600.

D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces except where otherwise specified.

E. Special Finish: Exposed surfaces of hardware for dark bronze anodized aluminum doors shall have oxidized, oil-rubbed bronze finish (dark bronze). Finish on door closers shall closely match doors.

F. Anti-microbial Coating: All hand-operated hardware (levers, pulls, push bars, push plates, paddles, and panic bars) shall be provided with an anti-microbial/anti-fungal coating that has passed ASTM E2180 tests. Coating to consist of ionic silver (Ag+). Silver ions surround

bacterial cells, inhibiting growth of bacteria, mold, and mildew by
blockading food and respiration supplies.

2.31 BASE METALS

- A. Apply specified U.S. Standard finishes on different base metals as
following:

Finish	Base Metal
652	Steel
626	Brass or bronze
630	Stainless steel

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

- A. For existing buildings locate hardware on doors at heights to match
existing hardware. The Contractor shall visit the site, verify location
of existing hardware, and submit locations to VA COR for approval.
- B. For new buildings, locate hardware on doors at heights specified below,
with all hand-operated hardware centered within 34 inches to 48 inches,
unless otherwise noted:
- C. Hardware Heights from Finished Floor:
1. Exit devices centerline of strike (where applicable) 40-5/16 inches.
 2. Locksets and latch sets centerline of strike 40-5/16 inches.
 3. Deadlocks centerline of strike 48 inches.
 4. Hospital arm pull 46 inches to centerline of bottom supporting
bracket.
 5. Centerline of door pulls to be 40 inches.
 6. Push plates and push-pull shall be 50 inches to top of plate.
 7. Push-pull latch to be 40-5/16 inches to centerline of strike.
 8. Locate other hardware at standard commercial heights. Locate push
and pull plates to prevent conflict with other hardware.

3.2 INSTALLATION

- A. Closer devices, including those with hold-open features, shall be
equipped and mounted to provide maximum door opening permitted by
building construction or equipment. Closers shall be mounted on side of
door inside rooms, inside stairs, and away from corridors except
security bedroom, bathroom and anteroom doors which shall have closer
installed parallel arm on exterior side of doors. At exterior doors,
closers shall be mounted on interior side. Where closers are mounted on

doors they shall be mounted with sex nuts and bolts; foot shall be fastened to frame with machine screws.

B. Hinge Size Requirements:

Door Thickness	Door Width	Hinge Height
1-3/4 inches	3 feet and less	4-1/2 inches
1-3/4 inches	Over 3 feet but not more than 4 feet	5 inches
1-3/8 inches (hollow core wood doors)	Not over 4 feet	4-1/2 inches

C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.

D. Where new hinges are specified for new doors in existing frames or existing doors in new frames, sizes of new hinges shall match sizes of existing hinges; or, Contractor may reuse existing hinges provided hinges are restored to satisfactory operating condition as approved by COR. Existing hinges shall not be reused on door openings having new doors and new frames. Coordinate preparation for hinge cut-outs and screw-hole locations on doors and frames.

E. Hinges Required Per Door:

Doors 5 feet or less in height	2 butts
Doors over 5 feet high and not over 7 feet 6 inches high	3 butts
Doors over 7 feet 6 inches high	4 butts
Dutch-type doors	4 butts
Doors with spring hinges 4 feet 6 inches high or less	2 butts
Doors with spring hinges over 4 feet 6 inches	3 butts

F. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.

G. After locks have been installed, show in presence of COR that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also, a copy

of the invoice shall be sent to the COR for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on Project.

3.3 FINAL INSPECTION

- A. Installer to provide letter to VA COR that upon completion, installer has visited the Project and has accomplished the following:
 - 1. Readjust hardware.
 - 2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
 - 3. Identify items that have deteriorated or failed.
 - 4. Submit written report identifying problems.

3.4 DEMONSTRATION

- A. Demonstrate efficacy of mechanical hardware and electrical and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of COR and VA Locksmith.

3.5 HARDWARE SETS

- A. Following sets of hardware correspond to hardware symbols shown on Drawings. Only those hardware sets that are shown on Drawings will be required. Disregard hardware sets listed in Specifications but not shown on Drawings.
- B. Hardware Consultant working on a Project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

ELECTRIC HARDWARE ABBREVIATIONS LEGEND:

ADO = Automatic Door Operator

EMCH = Electro-Mechanical Closer-Holder

MHO = Magnetic Hold-Open (wall- or floor-mounted)

INTERIOR SINGLE DOORS

HW-1

Each Door to Have:

NON-RATED

1	Continuous Hinge	
1	Door Pull with Plate	J401 x J302
1	Push Plate	J302
1	Kick Plate	J102
1	Mop Plate (at Inswing Doors)	J103
1	Closer	C02011/C02021
1	Floor Stop	L02121 x 3 FASTENERS
3	Silencers	L03011

HW-1A

Each Door to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
	X HOSPITAL TIPS AT INSWING DOORS
1 Latchset	F01
1 Closer	C02011/C02021
	X INSTALL OUTSIDE ROOM
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Floor Stop	L02121 x 3 FASTENERS
1 Threshold	J32300 x 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
1 Set Seals	R0Y164

HW-1B

Each Door to Have:

NON-RATED/RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X SWING-CLEAR X ADJUSTA-SCREWS
1 Hospital Latch	F01 X PADDLES POINTING DOWN
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Overhead Stop	C01541-ADJUSTABLE
1 Set Seals	R0Y164
NO CLOSER REQUIRED DUE TO EXEMPTION FOR PATIENT ROOM DOORS.	

HW-1C

THIS SET NOT USED.

HW-1D

Each Door to Have:

NON-RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X SWING-CLEAR X ADJUSTA-SCREWS
1 Hospital Latch	F01 X PADDLES POINTING DOWN
1 Armor Plate	J101 x 0.050-INCH THICKNESS
1 Mop Plate	J103
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Overhead Stop	C01541-ADJUSTABLE
3 Silencers	L03011

HW-1E

Each Door to Have:

RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X SWING-CLEAR X ADJUSTA-SCREWS
1	Hospital Latch	F01 X PADDLES POINTING DOWN
1	Closer	C02011/C02021
1	Armor Plate	J101 x 0.050-INCH THICKNESS
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Wall Stop (at Inswing Doors)	L02101 CONVEX
1	Set Self-Adhesive Seals	R0Y154

HW-1F

Each Door to Have:

NON-RATED

1	Continuous Hinge	
1	Latchset	F01
1	Kick Plate	J102
1	Wall Stop	L02101 CONVEX
3	Silencers	L03011

HW-1G

Each Door to Have:

NON-RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Latchset	F01
1	Kick Plate	J102
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Wall Stop	L02101 CONVEX
3	Silencers	L03011
1	Coat Hook	L03121

HW-1H

Each Dwarf Door to Have:

NON-RATED

1	Gate Spring Pivot Hinge	K13311
1	Door Bolt	L04151
1	Wall Stop	L02101 CONVEX
2	Silencers	L03021

HW-1J

Each [MHO] Door to Have:

RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Latchset	F01
1	Closer	C02011/C02021
1	Heavy-Duty Armor Plate	J101 X 0.125-INCH THICKNESS
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Magnetic Holder	C00011 TRI-VOLTAGE
1	Set Self-Adhesive Seals	R0Y154

POWER, WIRING, CONDUIT, AND FIRE ALARM CONNECTION BY DIVISION 26.

HW-1K

Each Door to Have:

NON-RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Hospital Latch	F01 X PADDLES POINTING DOWN
1	Closer	C02011/C02021
1	Armor Plate	J101 x 0.050-INCH THICKNESS
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Overhead Stop	C01541-ADJUSTABLE
1	Auto Door Bottom	R0Y346 - HEAVY DUTY
2	Sets Self-Adhesive Seals	R0Y154

HW-1L

Each Door to Have:

NON-RATED

1	Continuous Hinge	
1	Latchset	F01
1	Kick Plate	J102
1	Wall Stop	L02101 CONVEX
1	Threshold	J32300 x 2-1/4-INCH WIDTH
1	Auto Door Bottom	R0Y346 - HEAVY DUTY
2	Sets Self-Adhesive Seals	R0Y154

HW-1M

Each Door to Have:

NON-RATED

1	Floor Closer	C06011
2	Push Plates	J302
2	Kick Plates	J102
2	Edge Guard (at Wood Doors)	J209M/J212 (VERIFY)
1	Overhead Stop	C01541-ADJUSTABLE

HW-1N

Each Door to Have:

NON-RATED

1	Continuous Hinge	
1	Door Pull w/ Plate	J401 x J302
1	Push Plate	J302
1	Kick Plate	J102
1	Mop Plate (at Inswing Doors)	J103
1	Closer	C02011/C02021
1	Floor Stop	L02121 x 3 FASTENERS
3	Silencers	L03011

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HW-1P

Each Lead-Lined Door to Have:

NON-RATED

1	Floor Closer	C6062
2	Push Plates	J302 8" x 16"
2	Kick Plates	J102
2	Edge Guard (at Wood Doors)	J209M/J212 (VERIFY)
1	Overhead Stop	C01541-ADJUSTABLE

HW-1Q

Each Door to Have:

RATED/NON-RATED

1	Continuous Hinge	
1	Latchset	F01
1	Kick Plate	J102
1	Closer (at rated doors)	C02011/C02021
1	Wall Stop	L02101 CONVEX
1	Threshold	J32300 x 2-1/4-INCH WIDTH
1	Auto Door Bottom	R0Y346 - HEAVY DUTY
2	Sets Self-Adhesive Seals	R0Y154

HW-1R

Each Door to Have:

RATED/NON-RATED

1 Continuous Hinge	
1 Latchset	F01
1 Kick Plate	J102
1 Closer (at rated doors)	C02011/C02021
1 Wall Stop	L02101 CONVEX
1 Set Self-Adhesive Seals	R0Y154

HW-2

Each Door to Have:

RATED/NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Keyed Privacy Indicator Lock	F13 x OCCUPANCY INDICATOR
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Floor Stop	L02121 x 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

STONE THRESHOLD BY OTHER TRADES.

HW-2A

Each [ADO] Door to Have:

RATED/NON-RATED

1 Continuous Transfer Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS x 8-THRUWIRE TRANSFER X IN-HINGE ACCESS PANEL
1 Keyed Privacy Indicator Lock	F13 x OCCUPANCY INDICATOR
1 Electric Strike	E09391 (FAIL-SECURE), 24V DC
1 Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 x 3 FASTENERS
1 Threshold	J32300 x 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Set Self-Adhesive Seals	R0Y154

AUTOMATIC DOOR OPERATOR AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.
STONE THRESHOLD BY OTHER TRADES.

HW-2B

Each Door to Have:

NON-RATED

1 Center Pivot Set	C07042
1 Privacy Lock	F02-MOD x THUMBTURN BOTH SIDES X OCCUPANCY INDICATOR
1 Rescue Stop	A1882
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Wall Stop	L02101 CONVEX

STONE THRESHOLD BY OTHER TRADES.

HW-2C

Each Door to Have:

NON-RATED

	Hinges	QUANTITY AND TYPE AS REQUIRED
1	Privacy Lock	F02-MOD X OCCUPANCY INDICATOR
1	Kick Plate	J102
1	Mop Plate (at Inswing Doors)	J103
1	Wall Stop	L02101 CONVEX
3	Silencers	L03011
STONE THRESHOLD BY OTHER TRADES.		

HW-2D

Each Door to Have:

RATED

	Hinges	QUANTITY AND TYPE AS REQUIRED
1	Privacy Lock	F02-MOD X OCCUPANCY INDICATOR
1	Closer	C02011/C02021
1	Kick Plate	J102
1	Mop Plate (at Inswing Doors)	J103
1	Wall Stop	L02101 CONVEX
1	Set Self-Adhesive Seals	R0Y154
STONE THRESHOLD BY OTHER TRADES.		

HW-2E

Each Door to Have:

RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Hospital Privacy Latch	F02-MOD X TURNPIECE BOTH SIDES
1	Closer	C02011/C02021
1	Armor Plate	J101 X 0.050-INCH THICKNESS
1	Mop Plate (at Inswing Doors)	J103
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Overhead Stop	C01541-ADJUSTABLE
1	Set Self-Adhesive Seals	R0Y154
STONE THRESHOLD BY OTHER TRADES.		

HW-2F

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Privacy Lock	F02-MOD X OCCUPANCY INDICATOR
1 Wall Stop	L02101 CONVEX
3 Silencers	L03011
1 Coat Hook	L03121

HW-2G

Each Door to Have:

RATED/NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Keyed Privacy Indicator Lock	F13 X OCCUPANCY INDICATOR
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Floor Stop	L02121 X 3 FASTENERS
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Set Self-Adhesive Seals	R0Y154
STONE THRESHOLD BY OTHER TRADES.	

HW-2H

Each Door to Have:

NON-RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Hospital Privacy Latch	F02-MOD X TURNPIECE BOTH SIDES X OCCUPANCY INDICATOR
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Overhead Stop	C01541-ADJUSTABLE
3 Silencers	L03011
STONE THRESHOLD BY OTHER TRADES.	

HW-2J

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Privacy Lock	F02-MOD X OCCUPANCY INDICATOR
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Wall Stop	L02101 CONVEX
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Set Self-Adhesive Seals	R0Y154
STONE THRESHOLD BY OTHER TRADES.	

HW-2K

Each Door to Have:

NON-RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Hospital Privacy Latch	F02-MOD X TURNPIECE BOTH SIDES X OCCUPANCY INDICATOR
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Overhead Stop	C01541-ADJUSTABLE
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Set Self-Adhesive Seals	R0Y154
STONE THRESHOLD BY OTHER TRADES.	

HW-3

Each Door to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Office Lock	F04
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Floor Stop	L02121 x 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-3A

Each Door to Have:

NON-RATED

THIS SET NOT USED.

HW-3B

Each Door to Have:

NON-RATED/RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Office Lock	F04
1 Closer	C02011/C02021
1 Floor Stop	L02121 x 3 FASTENERS
1 Door Viewer	L03221 - 190° (VIEW INTO CORRIDOR)
1 Set Self-Adhesive Seals	R0Y154

OMIT VIEWER IF DOOR PROVIDED WITH VISION LITE.

HW-3C

THIS SET NOT USED.

HW-3D

Each Door to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Office Lock	F04
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Floor Stop	L02121 x 3 FASTENERS
1 Threshold	J32300 x 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-3E

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Office Lock	F04
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154
1 Coat Hook	L03121
OMIT COAT HOOK WHERE GLASS LITE PREVENTS INSTALLATION.	

HW-3F

Each Door to Have:

RATED/NON-RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Office Lock	F04
1 Closer	CO2011/CO2021 AT RATED DOOR
1 Kick Plate	J102
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-3G

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Office Lock	F04
1 Floor Stop	L02121 x 3 FASTENERS
1 Coat Hook	L03121
1 Door Viewer (Mental Health Only)	L03221 - 190° (VIEW INTO CORRIDOR)
1 Threshold	J32300 x 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154
OMIT VIEWER IF DOOR PROVIDED WITH VISION LITE.	
OMIT COAT HOOK WHERE GLASS LITE PREVENTS INSTALLATION.	

HW-3H

Each Door to Have:

RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Office Lock	F04
1 Closer	CO2011/CO2021
1 Kick Plate	J102
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Sets Self-Adhesive Seals	R0Y154

HW-3J

Each Door to Have:

NON-RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Office Lock	F04
1	Kick Plate	J102
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Floor Stop	L02121 X 3 FASTENERS
1	Threshold	J32300 X 2-1/4-INCH WIDTH
1	Auto Door Bottom	R0Y346 - HEAVY DUTY
1	Set Sound/Light Seals	R0Y264/R0Y255

HW-4

Each Door to Have:

NON-RATED

	Hinges	QUANTITY AND TYPE AS REQUIRED
1	Classroom Lock	F08
1	Overhead Stop	C04541
3	Silencers	L03011

HW-4A

Each [ADO] Door to Have:

RATED

- | | | |
|---|------------------------------|---|
| 1 | Continuous Transfer Hinge | X INTEGRAL HINGE GUARD CHANNEL
X ADJUSTA-SCREWS X 4-THRUWIRE TRANSFER
X IN-HINGE ACCESS PANEL |
| 1 | Classroom Lock | F08 |
| 1 | Electric Strike | E09311 (FAIL-SECURE), 24V DC |
| 1 | Power Supply | REGULATED, FILTERED, 24V DC, AMPERAGE
AS REQUIRED |
| 1 | Kick Plate | J102 |
| 1 | Mop Plate (at Inswing Doors) | J103 at TOILET ROOMS ONLY |
| 1 | Edge Guard (at Wood Doors) | J208M/J211 (VERIFY), CUT: HARDWARE |
| 1 | Floor Stop | L02121 X 3 FASTENERS |
| 1 | Set Self-Adhesive Seals | R0Y154 |

AUTOMATIC DOOR OPERATOR AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

POWER TRANSFER FOR REACTIVATION SENSOR WIRING (REACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

HW-4B

Each Door to Have:

NON-RATED/RATED

- | | | |
|---|--------------------------------|---------------------------|
| 1 | Continuous Hinge | |
| 1 | Public Restroom Lock | F09 |
| 1 | Closer | C02011/C02021 |
| 1 | Closer | C02051/C02061 |
| 1 | Kick Plate | J102 |
| 1 | Mop Plate (at Inswing Doors) | J103 |
| 1 | Floor Stop (at Outswing Doors) | L02121 X 3 FASTENERS |
| 1 | Wall Stop (at Inswing Doors) | L02101 CONVEX |
| 1 | Threshold | J32300 X 2-1/4-INCH WIDTH |
| 1 | Auto Door Bottom | R0Y346 - HEAVY DUTY |
| 2 | Sets Self-Adhesive Seals | R0Y154 |

PROVIDE NON-HOLD-OPEN CLOSER AT TOILET ROOMS.

STONE THRESHOLD BY OTHER TRADES.

HW-4C

Each Door to Have:

RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Hospital Utility Lock	F09 X PADDLES POINTING DOWN
1	Key Cylinder	TYPE AS REQUIRED
1	Closer	C02011/C02021
1	Armor Plate	J101 X 0.050-INCH THICKNESS
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Overhead Stop	C01541-ADJUSTABLE
1	Threshold	J32300 X 2-1/4-INCH WIDTH
1	Auto Door Bottom	R0Y346 - HEAVY DUTY
1	Set Seals	R0Y164

HW-4D

Each Door to Have:

RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Classroom Lock	F08
1	Closer	C02011/C02021
1	Armor Plate	J101 X 0.050-INCH THICKNESS
1	Mop Plate (at Inswing Doors)	J103
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Floor Stop (at Outswing Doors)	L02121 X 3 FASTENERS
1	Wall Stop (at Inswing Doors)	L02101 CONVEX
1	Set Self-Adhesive Seals	R0Y154

HW-4E

Each Door to Have:

NON-RATED/RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Utility Lock	F09
1 Closer (at rated doors)	C02011/C02021
1 Closer (at non-rated doors)	C02051/C02061
1 Kick Plate	J102
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-4F

Each Door to Have:

RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Utility Lock	F09
1 Closer	C02011/C02021
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop (at Outswing Doors)	L02121 X 3 FASTENERS
1 Wall Stop (at Inswing Doors)	L02101 CONVEX
1 Set Self-Adhesive Seals	R0Y154

HW-4G

Each Door to Have:

RATED/NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Utility Lock	F09
1 Closer (at Rated Doors)	C02011/C02021
1 Kick Plate	J102
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-4H

Each [MHO] Door to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Classroom Lock	F08
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Magnetic Holder	C00011 TRI-VOLTAGE
1 Set Self-Adhesive Seals	R0Y154

POWER, WIRING, CONDUIT, AND FIRE ALARM CONNECTION BY DIVISION 26.

HW-4J

Each Door to Have:

RATED/NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Utility Lock	F09
1 Closer (at Rated Doors)	C02011/C02021
1 Kick Plate	J102
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-4K

Each Door to Have:

NON-RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Utility Lock	F09
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-4L

Each Door to Have:

NON-RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Classroom Lock	F08
1	Kick Plate	J102
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Floor Stop	L02121 X 3 FASTENERS
1	Threshold	J32300 X 2-1/4-INCH WIDTH
1	Auto Door Bottom	R0Y346 - HEAVY DUTY
1	Set Sound/Light Seals	R0Y264/R0Y255

HW-4M

Each Door to Have:

NON-RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Classroom Hospital Lock	F08 X PADDLES POINTING DOWN
1	Heavy-Duty Armor Plate	J101 X 0.125-INCH THICKNESS
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Floor Stop	L02121 x 3 FASTENERS
1	Set Self-Adhesive Seals	R0Y154

HW-4N

Each Door to Have:

RATED/NON-RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Utility Lock	F09
1	Closer (at rated doors)	C02011/C02021
1	Kick Plate	J102
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Floor Stop	L02121 X 3 FASTENERS
1	Threshold	J32300 X 2-1/4-INCH WIDTH
1	Auto Door Bottom	R0Y346 - HEAVY DUTY
2	Sets Self-Adhesive Seals	R0Y154

HW-4P

Each Door to Have:

NON-RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
		X ADJUSTA-SCREWS
1	Classroom Hospital Lock	F08 X PADDLES POINTING DOWN
1	Armor Plate	J101 X 0.050-INCH THICKNESS
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Overhead Stop	C01541-ADJUSTABLE
1	Threshold	J32300 X 2-1/4-INCH WIDTH
1	Auto Door Bottom	R0Y346 - HEAVY DUTY
2	Sets Self-Adhesive Seals	R0Y154

HW-4Q

Each Door to Have:

NON-RATED

1	Pivot Set	C07162 X 1,000 LBS WEIGHT CAPACITY
1	Intermediate Pivot	C07311
1	Utility Hospital Lock	F09 X LEAD-LINED X PADDLES POINTING DOWN
1	Armor Plate	J101 X 0.050-INCH THICKNESS
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Overhead Stop	C01541-ADJUSTABLE
1	Set Self-Adhesive Seal	R0Y154

HW-4R

Each [ADO] Door to Have:

RATED

- | | | |
|---|------------------------------|---|
| 1 | Continuous Hinge | X INTEGRAL HINGE GUARD CHANNEL
X ADJUSTA-SCREWS X 4-THRUWIRE TRANSFER
X IN-HINGE ACCESS PANEL |
| 1 | Classroom Lock | F08 |
| 1 | Electric Strike | E09311 (FAIL-SECURE), 24V DC |
| 1 | Power Supply | REGULATED, FILTERED, 24V DC, AMPERAGE
AS REQUIRED |
| 1 | Kick Plate | J102 |
| 1 | Mop Plate (at Inswing Doors) | J103 AT TOILET ROOMS ONLY |
| 1 | Edge Guard (at Wood Doors) | J208M/J211 (VERIFY), CUT: HARDWARE |
| 1 | Floor Stop | L02121 X 3 FASTENERS |
| 1 | Threshold | J32300 X 2-1/4-INCH WIDTH |
| 1 | Auto Door Bottom | R0Y346 - HEAVY DUTY |
| 2 | Set Self-Adhesive Seals | R0Y154 |

AT TOILET ROOMS, OMIT METAL THRESHOLD; STONE THRESHOLD BY OTHER TRADES.
AUTOMATIC DOOR OPERATOR AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR
OPERATORS.

POWER TRANSFER FOR REACTIVATION SENSOR WIRING (REACTIVATION SENSORS
PROVIDED BY SECTION 08 71 13).

HW-4S

Each Door to Have:

NON-RATED

- | | | |
|---|----------------------------|--|
| 1 | Continuous Hinge | X INTEGRAL HINGE GUARD CHANNEL
X ADJUSTA-SCREWS |
| 1 | Classroom Lock | F08 |
| 1 | Heavy-Duty Armor Plate | J101 X 0.125-INCH THICKNESS |
| 1 | Edge Guard (at Wood Doors) | J208M/J211 (VERIFY), CUT: HARDWARE |
| 1 | Floor Stop | L02121 X 3 FASTENERS |
| 1 | Auto Door Bottom | R0Y346 - HEAVY DUTY |
| 2 | Sets Self-Adhesive Seals | R0Y154 |

HW-4T

Each Door to Have:

NON-RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS
1 Classroom Hospital Lock	F08 X PADDLES POINTING DOWN
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Overhead Stop	C01541-ADJUSTABLE
1 Set Self-Adhesive Seals	R0Y154

HW-4U

Each Door to Have:

NON-RATED/RATED

1 Continuous Hinge	
1 Public Restroom Lock	F09
1 Closer	C02011/C02021
1 Closer	C02051/C02061
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Floor Stop (at Outswing Doors)	L02121 X 3 FASTENERS
1 Wall Stop (at Inswing Doors)	L02101 CONVEX
1 Set Self-Adhesive Seals	R0Y154

PROVIDE NON-HOLD-OPEN CLOSER AT TOILET ROOMS.

STONE THRESHOLD BY OTHER TRADES.

HW-4V

Each Lead-Lined Door to Have:

NON-RATED

1	Pivot Set	C07162 X 1,000 LBS WEIGHT CAPACITY
1	Intermediate Pivot	C07311
1	Utility Hospital Lock	F09 X LEAD-LINED X PADDLES POINTING DOWN
1	Closer	CO2011/CO2021 X METAL LEAD-LINED COVER
1	Armor Plate	J101 X 0.050-INCH THICKNESS
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Overhead Holder-Stop	C01541-ADJUSTABLE
1	Set Self-Adhesive Seal	R0Y154

HW-4X

Each [ADO] Lead-Lined Door to Have:

NON-RATED

1	Pivot Set	C07162 X 1,000 LBS WEIGHT CAPACITY
1	Intermediate Transfer Pivot	C07311 X 4 WIRE TRANSFER
1	Utility Hospital Lock	F09 X LEAD-LINED X PADDLES POINTING DOWN
1	Electric Unlatch Strike	E09321
1	Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1	Armor Plate	J101 X 0.050-INCH THICKNESS
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Overhead Stop	C01541-ADJUSTABLE
1	Set Self-Adhesive Seal	R0Y154

POWER TRANSFER PIVOT IS FOR REACTIVATION SENSOR WIRING (REACTIVATION
SENSORS PROVIDED BY SECTION 08 71 13).

AUTO DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13.

HW-4Y

Each [ADO] Door to Have:

NON-RATED

- | | | |
|---|----------------------------|--|
| 1 | Continuous Hinge | X INTEGRAL HINGE GUARD CHANNEL |
| | | X ADJUSTA-SCREWS X 4-THRUWIRE TRANSFER |
| | | X IN-HINGE ACCESS PANEL |
| 1 | Utility Hospital Lock | F09 X PADDLES POINTING DOWN |
| 1 | Electric Unlatch Strike | E09321 |
| 1 | Power Supply | REGULATED, FILTERED, 24V DC, AMPERAGE
AS REQUIRED |
| 1 | Armor Plate | J101 X 0.050-INCH THICKNESS |
| 1 | Edge Guard (at Wood Doors) | J208M/J211 (VERIFY), CUT: HARDWARE |
| 1 | Overhead Stop | C01541-ADJUSTABLE |
| 1 | Set Self-Adhesive Seals | R0Y154 |

POWER TRANSFER PIVOT IS FOR REACTIVATION SENSOR WIRING (REACTIVATION
SENSORS PROVIDED BY SECTION 08 71 13).

AUTOMATIC DOOR OPERATOR AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR
OPERATORS.

HW-5

Each Door to Have:

RATED

- | | | |
|---|-------------------------|---|
| | Hinges | QUANTITY AND TYPE AS REQUIRED |
| 1 | Storeroom Lock | F07 |
| 1 | Closer | C02011/C02021 |
| 1 | Kick Plate | J102 (AT STORAGE, EVM, AND HAC ROOMS
ONLY) |
| 1 | Floor Stop | L02121 X 3 FASTENERS |
| 1 | Set Self-Adhesive Seals | R0Y154 |

HW-5A

THIS SET NOT USED.

HW-5B

Each Door to Have:

RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Storeroom Lock	F07
1 Closer	C02011/C02021
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-5C

THIS SET NOT USED.

HW-5D

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Storeroom Lock	F07
1 Kick Plate	J102 (AT STORAGE, EVM, & HAC ROOMS ONLY)
1 Floor Stop (at Inswing Doors)	L02121 X 3 FASTENERS
1 Wall Stop (at Outswing Doors)	L02101 CONVEX
3 Silencers	L03011

HW-5E

Each Door to Have:

NON-RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Storeroom Lock	F13-MOD X RIGID OUTSIDE LEVER X KEY RETRACTS DEADBOLT AND LATCHBOLT
1 Armor Plate	J101 X 0.125-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-5F

Each Door to Have:

RATED/NON-RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Storeroom Lock	F07
1 Closer (at Rated Doors)	C02011/C02021
1 Heavy-Duty Armor Plate	J101 X 0.125-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-5G

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Storeroom Lock	F07
1 Kick Plate	J102
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-5H

Each Dutch Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Dutch Door Bolt	L04161-4" AT TOP LEAF
1 Storeroom Lock	F07 AT BOTTOM LEAF
1 Kick Plate	J102
1 Floor Stop	L02121 X 3 FASTENERS AT BOTTOM LEAF
1 Wall Stop	L02101 AT BOTTOM LEAF
1 Set Self-Adhesive Seals	R0Y154

HW-5J

Each Door to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Storeroom Lock	F07
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-5K

Each Door to Have:

RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Storeroom Lock	F07
1 Closer	C02011/C02021
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-5L

Each Door to Have:

NON-RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Security Storeroom Lock	F13-MOD X RIGID OUTSIDE LEVER X KEY RETRACTS DEADBOLT AND LATCHBOLT
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-6

Each Door to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Exit Device	TYPE 1 F13 LEVER
1 Key Cylinder	TYPE AS REQUIRED
1 Closer	C02011/C02021
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-6A

Each Door to Have:

RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X HOSPITAL TIP X ADJUSTA-SCREWS
1 Exit Device	TYPE 1 F08 LEVER
1 Key Cylinder	TYPE AS REQUIRED
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154/R0Y155

HW-6B

Each [MHO] Door to Have:

RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS
1 Exit Device	TYPE 1 F08 LEVER
1 Key Cylinder	TYPE AS REQUIRED
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Magnetic Holder	C00011 TRI-VOLTAGE
1 Set Self-Adhesive Seals	R0Y154

POWER, WIRING, CONDUIT, AND FIRE ALARM CONNECTION BY DIVISION 26.

HW-6C

Each Door to Have:

NON-RATED/RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS
1 Exit Device	TYPE 1 F08 LEVER
1 Key Cylinder	TYPE AS REQUIRED
1 Closer	C02021
1 Kick Plate	J102
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-6D

Each [ADO] Integrated Door to Have:

RATED

1 Key Cylinder	TYPE AS REQUIRED
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ALL HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES
AUTO DOOR OPERATOR AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR
OPERATORS.

HW-6E

Each Door to Have:

NON-RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS
1 Exit Device	TYPE 1 F08 LEVER
1 Key Cylinder	TYPE AS REQUIRED
1 Kick Plate	J102
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-6F

Each [ADO] Door to Have:

NON-RATED/RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS X 8-THRUWIRE
	TRANSFER X IN-HINGE ACCESS PANELS
1 Elec. Exit Device	TYPE 1 F08 LEVER (E04)
1 Key Cylinder	TYPE AS REQUIRED
1 Power Supply	BY EXIT DEVICE MFR. FOR E04 FUNCTION
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

POWER TRANSFER **SHARED BY ELECTRIC PANIC AND** REACTIVATION SENSOR WIRING
(REACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).
AUTO DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13.

HW-6G

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Exit Device	TYPE 1 F13 LEVER
1 Key Cylinder	TYPE AS REQUIRED
1 Closer	C02011/C02021
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-7

Each Motorized Roll-up Door to Have:

NON-RATED

1 Key Cylinder (for keyswitch) TYPE AS REQUIRED
BALANCE OF HARDWARE BY SECTION 08 33 00, COILING DOORS AND GRILLES

HW-7A

Each Special Door to Have:

NON-RATED

1 Padlock TYPE AS REQUIRED PER 08 71 00 2.29.
BALANCE OF HARDWARE BY DOOR MANUFACTURER.

HW-7B

Each RF Shielded Door to Have:

NON-RATED

1 Key Cylinder TYPE AS REQUIRED
BALANCE OF HARDWARE BY SECTION 13 49 00.

INTERIOR PAIRS OF DOORS

HW-8

Each [MHO] Pair Integrated Doors to Have:

RATED

ALL HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES

HW-8A

Each Aluminum Storefront Pair to Have:

NON-RATED

2	Floor Closers	C06041
2	Intermediate Pivots	C07321
2	Push/Pull Bar Sets	J505 - 12-INCH CENTER-TO-CENTER PULL
2	Overhead Stops	C01541-ADJUSTABLE

HW-8B

Each Pair to Have:

NON-RATED

2	Continuous Hinge	
2	Push Plate	J304 8" X 16"
2	Hospital Grip	J401
2	Kick Plate	J102
2	Mop Plate (at Inswing Doors)	J103
2	Closer	C02011/C02021
2	Floor Stop	L02121 X 3 FASTENERS
2	Silencers	L03011

HW-8C

Each Double-Acting Pair to Have:

NON-RATED

2	Double-Acting Floor Closers	C06011
4	Push Plates	J304 8" X 16"
4	Heavy-Duty Armor Plates	J101 X 0.125-INCH THICKNESS
4	Edge Guard (at Wood Doors)	J209P/J212 (VERIFY)
2	Overhead Holders	C01511-ADJUSTABLE

HW-8D

Each [ADO] Aluminum Storefront Pair to Have:

NON-RATED

2	Pivot Sets	C07162
2	Intermediate Transfer Pivots	C07321 X 4-WIRES
2	Intermediate Pivots	C07321
2	Push/Pull Bar Sets	J505 - 12-INCH CENTER-TO-CENTER PULL
2	Overhead Stops	C01541-ADJUSTABLE

AUTO DOOR OPERATORS, CONTROLS, AND REACTIVATION SENSORS BY SECTION

08 71 13.11.

POWER TRANSFERS FOR REACTIVATION SENSOR WIRING (REACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.

HW-8E

Each [ADO] Pair to Have:

NON-RATED

2	Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 4-THRUWIRE TRANSFERS X IN-HINGE ACCESS PANEL
2	Push Plate	J304 8" X 16"
2	Hospital Grip	J401
2	Kick Plate	J102
2	Mop Plate (at Inswing Doors)	J103
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Floor Stop	L02121 X 3 FASTENERS
2	Silencers	L03011

AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

POWER TRANSFERS FOR REACTIVATION SENSOR WIRING (REACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

HW-8F

Each [ADO] Pair to Have:

NON-RATED

2	Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 4-THRUWIRE TRANSFERS X IN-HINGE ACCESS PANEL
2	Push Plate	J304 8" X 16"
2	Hospital Grip	J401
2	Kick Plate	J102
2	Mop Plate (at Inswing Doors)	J103
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Floor Stop	L02121 X 3 FASTENERS
1	Threshold	J32300 X 2-1/4-INCH WIDTH
2	Auto Door Bottoms	R0Y346 - HEAVY DUTY
2	Set Self-Adhesive Seals	R0Y154

AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

POWER TRANSFERS FOR REACTIVATION SENSOR WIRING (REACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

HW-9

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-10

Each Pair to Have:

RATED

2	Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL
		X ADJUSTA-SCREWS
1	Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1	Classroom Lock	F08
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2	Closers	C02011/C02021
2	Heavy-Duty Armor Plates	J101 X 0.125-INCH THICKNESS
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Floor Stops	L02121 X 3 FASTENERS
1	Threshold	J32300 X 2-1/4-INCH WIDTH
2	Auto Door Bottoms	R0Y346 - HEAVY DUTY
2	Set Self-Adhesive Seals	R0Y154
INSTALL LOCK TRIM PROTECTOR BAR ON PUSH SIDE OF ACTIVE LEAF TO PROTECT LEVER TRIM.		

HW-10A

Each [ADO] Pair to Have:

NON-RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 8-THRUWIRE TRANSFER X IN-HINGE ACCESS PANEL
1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 4-THRUWIRE TRANSFER X IN-HINGE ACCESS PANEL
1	Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1	Classroom Lock	F08
1	Electric Unlatch Strike	E09321 (FAIL SECURE)
1	Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2	Armor Plates	J101 X 0.050-INCH THICKNESS
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Floor Stops	L02121 X 3 FASTENERS
1	Threshold	J32300 X 2-1/4-INCH WIDTH
2	Auto Door Bottoms	R0Y346 - HEAVY DUTY
2	Set Self-Adhesive Seals	R0Y154

AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

POWER TRANSFER **SHARED BY ELECTRIC STRIKE AND** REACTIVATION SENSOR WIRING (REACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

HW-10B

Each Pair to Have:

NON-RATED/RATED

2	Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL
		X ADJUSTA-SCREWS
1	Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1	Classroom Hospital Lock	F08 X PADDLES POINTING DOWN
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
1	Closers (at rated doors)	C02011/C02021
2	Heavy-Duty Armor Plates	J101 X 0.125-INCH THICKNESS
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Floor Stops	L02121 X 3 FASTENERS
INSTALL LOCK TRIM PROTECTOR BAR ON PUSH SIDE OF ACTIVE LEAF TO PROTECT LEVER TRIM.		

HW-10C

Each Pair to Have:

NON-RATED

2	Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL
		X ADJUSTA-SCREWS
1	Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1	Utility Lock	F09
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2	Kick Plates	J102
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Floor Stops	L02121 X 3 FASTENERS
1	Set Self-Adhesive Seals	R0Y154

HW-10D

Each Pair to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1 Classroom Lock	F08
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Kick Plates	J102
2 Floor Stops	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-10E

Each Lead Lined Pair to Have:

NON-RATED

2 Pivot Sets	C07162 X 1,000 LBS. WEIGHT CAPACITY
2 Intermediate Pivots	C07311
1 Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT x LEAD-LINED
1 Classroom Lock	F08 X LEAD-LINED X PADDLES POINTING DOWN
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS X LEAD-LINED
2 Armor Plates	J101 X 0.050-INCH THICKNESS
4 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Floor Stops	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-10F

Each Pair to Have:

NON-RATED

2 Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS
1 Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1 Classroom Hospital Lock	F08 X PADDLES POINTING DOWN
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Heavy-Duty Armor Plates	J101 X 0.125-INCH THICKNESS
2 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Floor Stops	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
2 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154
INSTALL LOCK TRIM PROTECTOR BAR ON PUSH SIDE OF ACTIVE LEAF TO PROTECT LEVER TRIM.	

HW-10G

Each Pair to Have:

NON-RATED

2 Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS
1 Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1 Classroom Lock	F08
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Heavy-Duty Armor Plates	J101 X 0.125-INCH THICKNESS
1 Lock Trim Protector Bar	R111LPB-630 (ROCKWOOD), OR EQUAL
2 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Floor Stops	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
2 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154
INSTALL LOCK TRIM PROTECTOR BAR ON PUSH SIDE OF ACTIVE LEAF TO PROTECT LEVER TRIM.	

HW-10H

Each [ADO] Lead-Lined Pair to Have:

RATED/NON-RATED

2	Bottom Pivots	C07162 LESS TOP PIVOT X 1,000 LBS. WEIGHT CAPACITY
1	Intermediate Pivot	C07311 (MIDDLE OF ACTIVE LEAF)
1	Intermediate Transfer Pivot	C07311 X 4-WIRE TRANSFER (MIDDLE OF INACTIVE LEAF)
2	Intermediate Transfer Pivot	C07311 X 4-WIRE TRANSFER (NEAR TOP OF EACH LEAF)
1	Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT X LEAD-LINED
1	Hospital Utility Lock	F09 X PADDLES POINTING DOWN X LEAD-LINED
1	Electric Unlatch Strike	E09321 (FAIL SECURE) (LEAD-LINED)
1	Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS X LEAD-LINED
2	Armor Plates	J101 X 0.050-INCH THICKNESS
4	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Overhead Stops	C01541-ADJUSTABLE
1	Set Self-Adhesive Seals	R0Y154

AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

POWER TRANSFER PIVOTS NEAR TOP OF EACH DOOR FOR REACTIVATION SENSOR WIRING (REACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

HW-10J

Each [ADO] Pair to Have:

RATED/NON-RATED

1 Continuous Transfer Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 8-THROUGHWIRE TRANSFER X IN-HINGE ACCESS PANEL
1 Continuous Transfer Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 4-THROUGHWIRE TRANSFER X IN-HINGE ACCESS PANEL
1 Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1 Classroom Hospital Lock	F08 X PADDLES POINTING DOWN
1 Electric Unlatch Strike	E09321 (FAIL-SECURE)
1 Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1 Coordinator	TYPE 21A
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Armor Plates	J101 X 0.050-INCH THICKNESS
2 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Overhead Stops	C01541-ADJUSTABLE
1 Set Self-Adhesive Seals	R0Y154

AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

POWER TRANSFERS **SHARED BY ELECTRIC STRIKE AND** REACTIVATION SENSOR WIRING (REACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

*AT WOOD PAIRS RATED 45 MINUTES OR MORE, PROVIDE ELECTRIC STRIKE 310-2-3/4 (FOLGER ADAM OR EQUAL) IN LIEU OF SPECIFIC UNLATCH STRIKE.

HW-10K

Each [ADO] Pair to Have:

RATED/NON-RATED

1 Continuous Transfer Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 8-THROUGHWIRE TRANSFER X IN-HINGE ACCESS PANEL
1 Continuous Transfer Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 4-THROUGHWIRE TRANSFER X IN-HINGE ACCESS PANEL
1 Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1 Classroom Lock	F08
1 Electric Unlatch Strike	E09321 (FAIL-SECURE)
1 Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1 Coordinator	TYPE 21A
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Armor Plates	J101 X 0.050-INCH THICKNESS
2 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Floor Stops	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

POWER TRANSFER **SHARED BY ELECTRIC STRIKE AND** REACTIVATION SENSOR WIRING (REACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

*AT WOOD PAIRS RATED 45 MINUTES OR MORE, PROVIDE ELECTRIC STRIKE 310-2-3/4 (FOLGER ADAM OR EQUAL) IN LIEU OF SPECIFIC UNLATCH STRIKE.

HW-10L

Each Pair to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1 Classroom Lock	F08
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Kick Plates	J102
2 Floor Stops	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
2 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-10M

Each Pair to Have:

NON-RATED

2 Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1 Utility Lock	F09
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Kick Plates	J102
2 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Floor Stops	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
2 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-11

Each Pair to Have:

RATED/NR

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1 Storeroom Lock	F07
1 Coordinator	TYPE 21A
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Closers	C02011/C02021
2 Kick Plates	J102 (AT STORAGE ROOMS ONLY)
2 Floor Stops	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-11A

Each Pair to Have:

NON-RATED

2 Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1 Set Auto Flush Bolts	TYPE 25
1 Security Storeroom Lock	F13-MOD X RIGID OUTSIDE LEVER X KEY RETRACTS DEADBOLT AND LATCHBOLT
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Armor Plates	J101 X 0.050-INCH THICKNESS
2 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Floor Stops	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-11B

Each Pair to Have:

RATED

2	Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Set Auto Flush Bolts	TYPE 25
1	Storeroom Lock	F07
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2	Closers	C02011/C02021
2	Armor Plates	J101 X 0.050-INCH THICKNESS
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Floor Stops	L02121 X 3 FASTENERS
1	Set Self-Adhesive Seals	R0Y154

HW-11C

Each Pair to Have:

RATED/NR

	Hinges	QUANTITY AND TYPE AS REQUIRED
1	Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1	Storeroom Lock	F07
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2	Closers	C02011/C02021
2	Kick Plates	J102 (AT STORAGE ROOMS ONLY)
2	Floor Stops	L02121 X 3 FASTENERS
1	Threshold	J32300 X 2-1/4-INCH WIDTH
2	Auto Door Bottoms	R0Y346 - HEAVY DUTY
2	Set Self-Adhesive Seals	R0Y154

HW-12

Each Pair to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Exit Device	TYPE 7 OR 8 F01
1 Exit Device	TYPE 7 OR 8 F08 LEVER
1 Key Cylinder	TYPE AS REQUIRED
1 Set Meeting Stile Astragals	R0Y834
2 Closers	C02011/C02021
2 Floor Stops	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-12A

Each [MHO] Pair Integrated Doors to Have:

RATED

ALL HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES

HW-12B

Each [ADO] Pair Integrated Doors to Have:

RATED

1 Key Cylinder TYPE AS REQUIRED
BALANCE OF HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES
AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR
OPERATORS.

HW-12C

Each [MHO] Pair Integrated Double Egress Doors to Have: RATED

ALL HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES

HW-12D

Each [ADO] Pair Integrated Double Egress Doors to Have: RATED

ALL HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES
AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR
OPERATORS.

HW-12E

Each Pair to Have:

RATED

2	Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL X HOSPITAL TIP X ADJUSTA-SCREWS
1	Exit Device	TYPE 7 OR 8 F01
1	Exit Device	TYPE 7 OR 8 F08 LEVER
1	Key Cylinder	TYPE AS REQUIRED
1	Set Meeting Stile Astragals	R0Y834
2	Closers	C02011/C02021
2	Kick Plates	J102
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Floor Stops	L02121 X 3 FASTENERS
2	Door Bottom	R0Y434 X NYLON BRUSH INSERT
2	Set Self-Adhesive Seals	R0Y154

HW-12F

Each Pair to Have:

RATED

	Hinges	QUANTITY AND TYPE AS REQUIRED
1	Exit Device	TYPE 7 OR 8 F01
1	Exit Device	TYPE 7 OR 8 F08 LEVER
1	Key Cylinder	TYPE AS REQUIRED
1	Set Meeting Stile Astragals	R0Y834
2	Closers	C02021
2	Floor Stops	L02121 X 3 FASTENERS
2	Door Bottom	R0Y434 X NYLON BRUSH INSERT
2	Sets Self-Adhesive Seals	R0Y154

HW-12G

Each Pair to Have:

NON-RATED

2 Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS
1 Exit Device	TYPE 7 OR 8 F01
1 Exit Device	TYPE 7 OR 8 F08 LEVER
1 Key Cylinder	TYPE AS REQUIRED
1 Set Meeting Stile Astragals	R0Y834
2 Closers	C02051/C02071
2 Kick Plates	J102
2 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Floor Stops	L02121 X 3 FASTENERS
2 Auto Door Bottoms	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-12H

Each [ADO] Pair to Have:

NON-RATED

2 Continuous Transfer Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS X 8-THROUGHWIRE
	TRANSFER X IN-HINGE ACCESS PANEL
1 Elec. Exit Device	TYPE 7 OR 8 F01 (E04)
1 Elec. Exit Device	TYPE 7 OR 8 F08 LEVER (E04)
1 Key Cylinder	TYPE AS REQUIRED
1 Power Supply	BY EXIT DEVICE MFR. FOR E04 FUNCTION
1 Set Meeting Stile Astragals	R0Y834
2 Kick Plates	J102
2 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Floor Stops	L02121 X 3 FASTENERS
2 Auto Door Bottoms	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

POWER TRANSFERS **SHARED BY ELECTRIC PANIC AND** REACTIVATION SENSOR WIRING
(REACTIONATION SENSORS PROVIDED BY SECTION 08 71 13).
AUTO DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13.

HW-12J

Each Pair to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Exit Device	TYPE 7 OR 8 F01
1 Exit Device	TYPE 7 RO 8 F13 LEVER
1 Key Cylinder	TYPE AS REQUIRED
1 Set Meeting Stile Astragals	R0Y834
2 Closers	C02011/C02021
2 Floor Stops	L02121 X 3 FASTENERS
2 Auto Door Bottoms	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-13

Each [ADO] Bi-Parting Automatic Pair to Have:

NON-RATED

ALL HARDWARE BY SECTION 08 42 29.

EXTERIOR SINGLE DOORS

HW-E1

Each Door to Have:

NON-RATED

1 Continuous Hinge	
1 Entry Lock	F11
1 Latch Protector (outswing dr)	
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold (outswing door)	J32120 X SILICONE GASKET
1 Threshold (inswing door)	ALUMINUM, PER ARCHITECTURAL DETAIL
1 Door Sweep	R0Y416
1 Set Frame Seals	R0Y164
1 Drip	R0Y976

HW-E2

Each Door to Have:

NON-RATED

1	Continuous Hinge	
1	Classroom Lock	F05
1	Closer	C02011/C02021
1	Kick Plate	J102
1	Floor Stop	L02121 X 3 FASTENERS
1	Threshold (outswing door)	J32120 X SILICONE GASKET
1	Threshold (inswing door)	ALUMINUM, PER ARCHITECTURAL DETAIL
1	Door Sweep	R0Y416
1	Set Frame Seals	R0Y164
1	Drip	R0Y976

HW-E3

Each Door to Have:

NON-RATED

1	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Storeroom Lock	F13-MOD X RIGID OUTSIDE LEVER X KEY RETRACTS DEADBOLT AND LATCHBOLT
1	Latch Protector (outswing dr)	
1	Closer	C02011/C02021
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1	Armor Plate	J101 X 0.125-INCH THICKNESS
1	Overhead Holder	C01511-ADJUSTABLE
1	Threshold (outswing door)	J32120 X SILICONE GASKET
1	Threshold (inswing door)	ALUMINUM, PER ARCHITECTURAL DETAIL
1	Door Sweep	R0Y416
1	Set Frame Seals	R0Y164
1	Drip	R0Y976

HW-E4

Each Door to Have:

NON-RATED

1	Continuous Hinge	
1	Anti-Vandal Pull	
1	Exit Device	TYPE 1 F03 LESS TRIM
1	Latch Protector (outswing door)	
1	Key Cylinder	TYPE AS REQUIRED
1	Closer	C02011
1	Kick Plate	J102
1	Floor Stop	L02121 X 3 FASTENERS
1	Threshold	J32120 X SILICONE GASKET
1	Door Sweep	R0Y416
1	Set Frame Seals	R0Y164
1	Drip	R0Y976

HW-E5

Each Roll-up Door to Have:

NON-RATED

1	Padlock or 2 Cylinders	TYPE AS REQUIRED
BALANCE OF HARDWARE BY SECTION 08 33 00, COILING DOORS AND GRILLES		

EXTERIOR PAIRS OF DOORS

<u>Each Pair to Have:</u>		<u>HW-E6</u>	<u>NON-RATED</u>
2	Continuous Hinge		
1	Set Auto Flush Bolts	TYPE 25	
1	Dust Proof Strike	L04021	
1	Entry Lock	F11	
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS	
1	Coordinator	TYPE 21A	
2	Closer	C02011/C02021	
2	Kick Plate	J102	
2	Floor Stop	L02121 X 3 FASTENERS	
1	Threshold (outswing door)	J32120 X SILICONE GASKET	
1	Threshold (inswing door)	ALUMINUM, PER ARCHITECTURAL DETAIL	
2	Door Sweep	R0Y416	
1	Set Frame Seals	R0Y164	
1	Drip	R0Y976	

HW-E7

Each Pair to Have:

NON-RATED

2	Continuous Hinge	
1	Set Auto Flush Bolts	TYPE 25
1	Dust Proof Strike	L04021
1	Classroom Lock	F05
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
1	Coordinator	TYPE 21A
2	Closer	C02011/C02021
2	Kick Plate	J102
2	Floor Stop	L02121 X 3 FASTENERS
1	Threshold (outswing door)	J32120 X SILICONE GASKET
1	Threshold (inswing door)	ALUMINUM, PER ARCHITECTURAL DETAIL
2	Door Sweep	R0Y416
1	Set Frame Seals	R0Y164
1	Drip	R0Y976

HW-E8

Each Pair to Have:

NON-RATED

2	Continuous Hinge	
1	Set Auto Flush Bolts	TYPE 25
1	Dust Proof Strike	L04021
1	Storeroom Lock	F13-MOD X RIGID OUTSIDE LEVER X KEY RETRACTS DEADBOLT AND LATCHBOLT
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
1	Coordinator	TYPE 21A
2	Closer	C02011/C02021
2	Armor Plate	J101 X 0.125-INCH THICKNESS
2	Floor Stop	L02121 X 3 FASTENERS
1	Threshold (outswing door)	J32120 X SILICONE GASKET
1	Threshold (inswing door)	ALUMINUM, PER ARCHITECTURAL DETAIL
2	Door Sweep	R0Y416
1	Set Frame Seals	R0Y164
1	Drip	R0Y976

HW-E9

Each Door to Have:

NON-RATED

2	Continuous Hinge	
1	Exit Device	TYPE 8 F01
1	Exit Device	TYPE 8 F12 LESS PULL
1	Key Cylinder	TYPE AS REQUIRED
2	Latch Protectors (outswing door)	
1	Set Meeting Stile Astragals	R0Y834
2	Closer	C02011
2	Kick Plate	J102
2	Floor Stop	L02121 X 3 FASTENERS
1	Threshold	J32120 X SILICONE GASKET
2	Door Sweep	R0416
1	Set Frame Seals	R0Y164
1	Drip	R0Y976

HW-E10

Each Sliding Door to Have:

NON-RATED

1	Set Track Hardware	TYPE REQUIRED FOR DOOR MATERIAL, WEIGHT, AND MOUNTING DETAILS (COMPLETE WITH TRACK, TRACK BRACKETS, HANGERS, GUIDES, BUMPERS, AND INTERNAL TRACK STOPS)
2	Pulls	TYPE AS REQUIRED
1	Sliding Door Lock	E8281/E8291 (SLIDING DOOR LOCK)
2	Cylinder (for sliding door lock)	TYPE AS REQUIRED

EXTERIOR SINGLE GATES

HW-G1

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-G2

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-G3

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-G4

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-G5

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

EXTERIOR PAIRS OF GATES

HW-G6

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-G7

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-G8

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-G9

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-G10

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

RESIDENTIAL UNIT SINGLE DOORS

HW-R1

Each Door to Have:

NON-RATED/RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Guestroom Card Lock	BY OTHER SECTION.
1 Closer (at Rated Doors)	C02011
1 Floor Stop	L02121 X 3 FASTENERS
2 Door Viewers	L03221 - 190°
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-R1A

Each Door to Have:

NON-RATED

1 Continuous Hinge	
1 Guestroom Card Lock	BY OTHER SECTION.
1 Latch Protector (at O/S Drs)	
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Floor Stop (at I/S Doors)	L02121 X 3 FASTENERS
1 Overhead Stop (at O/S Doors)	C01541-ADJUSTABLE
1 Threshold (outswing door)	J32120 X SILICONE GASKET
1 Threshold (inswing door)	ALUMINUM, PER ARCHITECTURAL DETAIL
1 Door Sweep	R0Y416
1 Set Frame Seals	R0Y164
1 Drip	R0Y976

HW-R2

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Latchset	F75
1 Base Stop	L02031 x 3 FASTENERS
3 Silencers	L03011

HW-R2A

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Door Pull with Plate	J401 X J302
1 Push Plate	J302
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Closer	C02011/C02021
1 Floor Stop	L02121 X 3 FASTENERS
3 Silencers	L03011

HW-R2B

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Latchset	F75
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-R2C

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Door Pull w/Plate	J401 X J302
1 Push Plate	J302
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Closer	C02011/C02021
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

HW-R3

Each Door to Have:

NON-RATED

	Hinges	QUANTITY AND TYPE AS REQUIRED
1	Privacy	F76B
1	Base Stop	L02031 X 3 FASTENERS
1	Coat Hook	L03121
3	Silencers	L03011

HW-R3A

Each Door to Have:

NON-RATED

	Hinges	QUANTITY AND TYPE AS REQUIRED
1	Privacy	F76B
1	Base Stop	L02031 X 3 FASTENERS
1	Coat Hook	L03121
1	Threshold	J32300 X 2-1/4-INCH WIDTH
1	Auto Door Bottom	R0Y346 - HEAVY DUTY
2	Sets Self-Adhesive Seals	R0Y154

AT TOILET ROOMS, OMIT METAL THRESHOLD; STONE THRESHOLD BY OTHER TRADES.

HW-R4

Each Door to Have:

RATED

	Hinges	QUANTITY AND TYPE AS REQUIRED
1	Classroom Lock	F84
1	Closer	C02011/C02021
1	Base Stop	L02031 X 3 FASTENERS
1	Set Self-Adhesive Seals	R0Y154

HW-R5

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

RESIDENTIAL UNIT PAIRS OF DOORS

HW-R6

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-R7

Each Pair to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
2 Dummy Sets	
2 Roller Latches	E09091 X MORTISE STRIKE
2 Base Stops	L02031 X 3 FASTENERS
2 Silencers	L03011

HW-R7A

Each Door to Have:

NON-RATED/RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1 Guestroom Card Lock	BY OTHER SECTION.
1 Coordinator	TYPE 21A
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Closer (at Rated Doors)	C02011
2 Floor Stop	L02121 X 3 FASTENERS
2 Door Viewers	L03221 - 190°
1 Threshold	J32300 X 2-1/4-INCH WIDTH
2 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

SECURITY HARDWARE ABBREVIATIONS LEGEND:

AC = Access Control Device (Card reader, biometric reader, keypad, etc.)
ADO = Automatic Door Operator
DEML = Delayed Egress Magnetic Lock
DEPH = Delayed Egress Panic Exit Device
DPS = Door Position Switch (Door or Alarm Contact)
EL = Electric Lock or Electric Lever Exit Device
PB = Push-button Combination Lock (Stand-alone)
RR = Remote Release Button
ELR = Electric Latch Retraction Exit Device
REX = Request-to-Exit Switch in Latching Device Inside Trim

INTERIOR SINGLE SECURITY DOORS

HW-SH-1

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-SH-2

Each Door to Have:

NON RATED

1	Continuous Hinge	
1	Door Pull with Plate	J401 X J302
1	Lock	DETENTION TYPE LOCK
1	Strike/Keeper	AS REQUIRED
1	Overhead Stop	C01541-ADJUSTABLE X SEC. TORX
1	Door Position Switch	

HW-SH-3

Each [AC, EL, REX, DPS] Door to Have:

RATED/NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Transfer Hinge	4-WIRE TYPE AS REQUIRED
1 Electrified Lock	F07 (E01-REX, E06) 24V DC
1 Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1 Closer	C02011/C02021
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154
1 Alarm Contact	
120-VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.	
CARD READER BY DIVISION 28.	

HW-SH-3A

THIS SET NOT USED.

HW-SH-3B

Each [PB] Door to Have:

RATED

1 Continuous Hinge	
1 Push-button Combination Lock	N3 - A156.13 F07 G1 E06
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-SH-3C

Each [PB] Door to Have:

NON-RATED/RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS
1 Push-button Combination Lock	N3 - A156.13 F07 G1 E06
1 Closer	C02011/C02021
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 x 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154

HW-SH-3D

Each [AC, EL, REX, DPS] Door to Have:

RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X ADJUSTA-SCREWS X 4-THROUGHWIRE
	TRANSFER X IN-HINGE ACCESS PANEL
1 Electrified Lock	F07 (E01-REX, E06) 24V DC
1 Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE
	AS REQUIRED
1 Closer	C02011/C02021
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154
1 Alarm Contact	
120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.	
CARD READER BY DIVISION 28.	

HW-SH-3E

Each [AC, EL, REX, DPS] Door to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Transfer Hinge	4-WIRE TYPE AS REQUIRED
1 Electrified Occupancy Indicator Lock	F13-MODIFIED (E01-REX, E06) 24V DC X OCCUPANCY INDICATOR X KEY RETRACTS LATCHBOLT AND DEADBOLT X INTERNAL DEADBOLT MONITOR SWITCH
1 Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1 Closer	C02011/C02021
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154
1 Alarm Contact	

INTERNAL DEADBOLT MONITOR SWITCH SHUNTS ACCESS CONTROL DEVICE WHEN
DEADBOLT IS THROWN.
120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.
CARD READER BY DIVISION 28.

HW-SH-3F

Each [AC, RR, EL, REX, DPS] Door to Have:

RATED

1 Continuous Transfer Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 4-THROUGHWIRE TRANSFER X IN-HINGE ACCESS PANEL
1 Electrified Lock	F13-MOD X RIGID OUTSIDE LEVER X NO INSIDE TURN X KEY RETRACTS LATCHBOLT AND DEADBOLT (E01-REX, E06) 24V DC
1 Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1 Closer	C02011/C02021
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154
1 Alarm Contact	
120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.	
CARD READER BY DIVISION 28.	

HW-SH-3G

Each [AC, RR, EL, REX, DPS] Door to Have:

RATED

1 Continuous Transfer Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 4-THROUGHWIRE TRANSFER X IN-HINGE ACCESS PANEL
1 Electrified Lock	F13-MOD X RIGID OUTSIDE LEVER X NO INSIDE TURN X KEY RETRACTS LATCHBOLT AND DEADBOLT (E01-REX, E06) 24V DC
1 Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1 Closer	C02011/C02021
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
1 Set Self-Adhesive Seals	R0Y154
1 Alarm Contact	

120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.
CARD READER BY DIVISION 28.

HW-SH-3H

Each [AC, EL, REX, DPS] Door to Have:

NON-RATED/RATED

1 Continuous Transfer Hinge	x 4-THRUWIRE TRANSFER x IN-HINGE ACCESS PANEL
1 Electrified Lock	F13-MOD x RIGID OUTSIDE LEVER X KEY RETRACTS LATCHBOLT AND DEADBOLT (E01- REX, E06) 24V DC
1 Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Floor Stop	L02121 x 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154
1 Door Viewer	L03221 - 190°
1 Alarm Contact	

120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.
CARD READER BY DIVISION 28.

HW-SH-4

Each [AC, EL, REX, DPS] Integrated Door to Have:

RATED

1 Key Cylinder	TYPE AS REQUIRED
----------------	------------------

BALANCE OF HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES

HW-SH-4A

Each [ADO, AC, ELR, REX, DPS] Integrated Door to Have:

RATED

1 Key Cylinder	TYPE AS REQUIRED
----------------	------------------

BALANCE OF HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES

HW-SH-4B

Each [ADO, AC, EL, REX, DPS] Door to Have:

RATED

- | | |
|------------------------------|---|
| 1 Continuous Transfer Hinge | X INTEGRAL HINGE GUARD CHANNEL
X ADJUSTA-SCREWS X 12-THROUGHWIRE
TRANSFER X IN-HINGE ACCESS PANEL |
| 1 Electrified Exit Device | TYPE 1 (E01-REX, E06) F13 LEVER |
| 1 Key Cylinder | TYPE AS REQUIRED |
| 1 Power Supply | TYPE REQUIRED BY PANIC MANUFACTURER X ADO
BOARD |
| 1 Armor Plate | J101 X 0.050-INCH THICKNESS |
| 1 Edge Guard (at Wood Doors) | J208M/J211 (VERIFY), CUT: HARDWARE |
| 1 Floor Stop | L02121 X 3 FASTENERS |
| 1 Set Self-Adhesive Seals | R0Y154 |

POWER TRANSFER **SHARED BY ELECTRIC PANIC AND** REACTIVATION SENSOR WIRING
(REACTION SENSORS PROVIDED BY SECTION 08 71 13).

AUTOMATIC DOOR OPERATOR AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR
OPERATORS.

HW-SH-5

2	Continuous Transfer Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 12 THROUGHWIRE TRANSFER X IN-HINGE ACCESS PANEL
2	Electrified Exit Device	TYPE 1 (E01-REX, E06) F13 LEVER
2	Key Cylinder	TYPE AS REQUIRED
1	Power Supply	TYPE REQUIRED BY PANIC MANUFACTURER X ADO BOARD
2	Closers	C02011/C02021
1	Removable Mullion	
2	Armor Plate	J101 X 0.050-INCH THICKNESS
1	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Floor Stop	L02121 X 3 FASTENERS
2	Threshold	J32300 X 2-1/4-INCH WIDTH
2	Auto Door Bottom	R0Y346 - HEAVY DUTY
2	Set Self-Adhesive Seals	R0Y154
2	Alarm Contacts	

120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.
CARD READER BY DIVISION 28.

HW-SH-6

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

INTERIOR PAIRS OF SECURITY DOORS

HW-SH-7

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-SH-8

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-SH-9

Each [AC, EL, REX, DPS] Pair to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
1 Transfer Hinge	4-WIRE TYPE AS REQUIRED
1 Set Auto Flush Bolts	TYPE 25
1 Dust Proof Strike	L04021
1 Electrified Lock	F07 (E01-REX, E06) 24V DC
1 Power Supply	REGULATED, FILTERED, 24V DC, AMPERAGE AS REQUIRED
1 Coordinator	TYPE 21A
1 Overlapping Astragal with Self-Adhesive Seal	R0Y634 x R0Y154 X THROUGH-BOLTS
2 Closers	C02011/C02021
2 Kick Plates	J102 (AT STORAGE ROOMS ONLY)
2 Floor Stops	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154
2 Alarm Contacts	
120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.	
CARD READER BY DIVISION 28.	

HW-SH-9A

Each [PB] Pair to Have:

RATED

2	Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Set Auto Flush Bolts	TYPE 25
1	Dust Proof Strike	L04021
1	Push-button Combination Lock	N3 - A156.13 F07 G1 E06
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R0Y634 X R0Y154 X THROUGH-BOLTS
2	Closers	C02011/C02021
2	Armor Plates	J101 X 0.050-INCH THICKNESS
2	Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2	Floor Stops	L02121 X 3 FASTENERS
1	Set Self-Adhesive Seals	R0Y154

HW-SH-10

Each [AC, EL, REX, DPS] Pair Integrated Doors to Have:

RATED

1	Key Cylinder	TYPE AS REQUIRED
---	--------------	------------------

BALANCE OF HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES

HW-SH-10A

Each [AC, ADO, EL, REX, DPS] Pair Integrated Doors to Have:

RATED

1	Key Cylinder	TYPE AS REQUIRED
---	--------------	------------------

BALANCE OF HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES.
AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR
OPERATORS.

EXTERIOR SINGLE SECURITY DOORS

HW-SH-12

Each [AC, ELR, REX, DPS] Integrated Door to Have:

NON-RATED

1 Key Cylinder TYPE AS REQUIRED
BALANCE OF HARDWARE BY SECTION 08 17 10, INTEGRATED DOOR ASSEMBLIES

MENTAL HEALTH AREAS

HW-MH1

Each Door to Have:

NON-RATED/RATED

1 Continuous Hinge X INTEGRAL HINGE GUARD CHANNEL
X HOSPITAL TIP X ADJUSTA-SCREWS
1 Passage Latch F01 X LESS TRIM
1 Set Anti-Ligature Trim
1 Armor Plate J101 X 0.050-INCH THICKNESS
1 Edge Guard (at Wood Doors) J208M/J211 (VERIFY), CUT: HARDWARE
1 Floor Stop L02121 X 3 FASTENERS
1 Set Seals R0Y164

PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.

NO CLOSER REQUIRED DUE TO EXEMPTION FOR PATIENT ROOM DOORS.

HW-MH1A

Each Door to Have:

RATED

Hinges	QUANTITY AND TYPE AS REQUIRED
	X HOSPITAL TIPS
1 Passage Latch	F01 X LESS TRIM
1 Set Anti-Ligature Trim	
1 Closer	C02011/C02021
	X INSTALL OUTSIDE ROOM
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Floor Stop	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
1 Set Seals	R0Y164
PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.	

HW-MH1B

Each Door to Have:

RATED/NON-RATED

1 Continuous Hinge	X HOSPITAL TIP
1 Passage Latch	F01 X LESS TRIM
1 Set Anti-Ligature Trim	
1 Kick Plate	J102
1 Closer (at rated doors)	C02011/C02021
1 Wall Stop	L02101 CONVEX
1 Threshold	J32300 X 2-1/4-INCH WIDTH
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154
INSTALL CLOSER OUTSIDE ROOM.	
PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.	

HW-MH2

Each Door to Have:

NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED X HOSPITAL TIP
1 Keyed Privacy Lock	F12-MOD X TURNPIECE BOTH SIDES X LESS TRIM
1 Set Anti-Ligature Trim	
2 Anti-Ligature Thumbturns	
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Floor Stop	L02121 X 3 FASTENERS
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
1 Set Seals	R0Y164
PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS. STONE THRESHOLD BY OTHER TRADES.	

HW-MH2A

Each Door to Have:

RATED/NON-RATED

Hinges	QUANTITY AND TYPE AS REQUIRED X HOSPITAL TIP
1 Keyed Privacy Indicator Lock	F13 X OCCUPANCY INDICATOR X LESS TRIM
1 Set Anti-Ligature Trim	
1 Anti-Ligature Thumbturn	
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Mop Plate (at Inswing Doors)	J103
1 Floor Stop	L02121 X 3 FASTENERS
1 Set Self-Adhesive Seals	R0Y154
INSTALL CLOSER OUTSIDE ROOM PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS. STONE THRESHOLD BY OTHER TRADES.	

HW-MH3

Each Door to Have:

NON-RATED

- | | |
|------------------------------|------------------------------------|
| 1 Continuous Hinge | X INTEGRAL HINGE GUARD CHANNEL |
| | X HOSPITAL TIP X ADJUSTA-SCREWS |
| 1 Classroom Lock | F05 X LESS TRIM |
| 1 Set Anti-Ligature Trim | CH (Accurate Lock), or equal |
| 1 Armor Plate | J101 X 0.050-INCH THICKNESS |
| 1 Mop Plate | J103 |
| 1 Edge Guard (at Wood Doors) | J208M/J211 (VERIFY), CUT: HARDWARE |
| 1 Floor Stop | L02121 X 3 FASTENERS |
| 3 Silencers | L03011 |

PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.

HW-MH3A

Each Door to Have:

RATED

- | | |
|------------------------------|------------------------------------|
| 1 Continuous Hinge | X INTEGRAL HINGE GUARD CHANNEL |
| | X HOSPITAL TIP X ADJUSTA-SCREWS |
| 1 Classroom Lock | F05 X LESS TRIM |
| 1 Set Anti-Ligature Trim | CH (Accurate Lock), OR EQUAL |
| 1 Closer | C02011/C02021 |
| 1 Armor Plate | J101 X 0.050-INCH THICKNESS |
| 1 Edge Guard (at Wood Doors) | J208M/J211 (VERIFY), CUT: HARDWARE |
| 1 Floor Stop | L02121 X 3 FASTENERS |
| 1 Set Self-Adhesive Seals | R0Y154 |

INSTALL CLOSER OUTSIDE ROOM.

PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.

HW-MH4

Each [AC, RR, EL, REX, DPS] Door to Have:

RATED

- | | | |
|---|----------------------------|--|
| 1 | Continuous Transfer Hinge | X INTEGRAL HINGE GUARD CHANNEL
X ADJUSTA-SCREWS X 4-THROUGHWIRE
TRANSFER X IN-HINGE ACCESS PANEL |
| 1 | Electrified Lock | F07 (E01-REX, E06) 24V DC X
LESS TRIM |
| 1 | Set Anti-Ligature Trim | |
| 1 | Power Supply | REGULATED, FILTERED, 24V DC, AMPERAGE
AS REQUIRED |
| 1 | Closer | C02011/C02021 |
| 1 | Kick Plate | J102 |
| 1 | Stretcher Plate | J101 |
| 1 | Edge Guard (at Wood Doors) | J208M/J211 (VERIFY), CUT: HARDWARE |
| 1 | Floor Stop | L02121 X 3 FASTENERS |
| 1 | Door Viewer | L03221 - 190° (VIEW INTO WAITING ROOM) |
| 1 | Door Viewer | L03221 - 190° (VIEW INTO TREATMENT AREA) |
| 1 | Set Self-Adhesive Seals | R0Y154 |
| 1 | Alarm Contact | 1078-G (G.E. SECURITY), OR EQUAL |

OMIT DOOR VIEWERS AT DOORS WITH VISION LITES.

INSTALL DOOR CLOSER ON WAITING ROOM SIDE.

PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.

120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.

CARD READER BY DIVISION 28.

HW-MH4A

Each Door to Have:

RATED

- | | |
|------------------------------|------------------------------------|
| 1 Continuous Hinge | X INTEGRAL HINGE GUARD CHANNEL |
| | X HOSPITAL TIP X ADJUSTA-SCREWS |
| 1 Lock | F08 X LESS TRIM |
| 1 Set Anti-Ligature Trim | |
| 1 Armor Plate | J101 X 0.050-INCH THICKNESS |
| 1 Edge Guard (at Wood Doors) | J208M/J211 (VERIFY), CUT: HARDWARE |
| 1 Floor Stop | L02121 X 3 FASTENERS |
| 1 Threshold | J32300 X 2-1/4-INCH WIDTH |
| 1 Auto Door Bottom | R0Y346 - HEAVY DUTY |
| 1 Set Seals | R0Y164 |

PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.

NO CLOSER REQUIRED DUE TO EXEMPTION FOR PATIENT ROOM DOORS.

HW-MH5

Each Door to Have:

RATED/NON-RATED

- | | |
|------------------------------|------------------------------------|
| 1 Continuous Hinge | X INTEGRAL HINGE GUARD CHANNEL |
| | X HOSPITAL TIP X ADJUSTA-SCREWS |
| 2 Anti-Ligature Pulls | |
| 1 Deadlatch | F30 LESS TRIM BOTH SIDES |
| 1 Armor Plate | J101 X 0.050-INCH THICKNESS |
| 1 Edge Guard (at Wood Doors) | J208M/J211 (VERIFY), CUT: HARDWARE |
| 1 Floor Stop | L02121 X 3 FASTENERS |
| 1 Threshold | J32300 X 2-1/4-INCH WIDTH |
| 1 Auto Door Bottom | R0Y346 - HEAVY DUTY |
| 1 Set Seals | R0Y164 |

PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.

NO CLOSER REQUIRED AT RATED DOORS DUE TO EXEMPTION FOR PATIENT ROOM DOORS.

HW-MH5A

Each Door to Have:

RATED

1 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X HOSPITAL TIP X ADJUSTA-SCREWS
2 Anti-Ligature Pulls	
1 Deadlatch	F30 LESS TRIM BOTH SIDES
1 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
1 Armor Plate	J101 X 0.050-INCH THICKNESS
1 Floor Stop	L02121 X 3 FASTENERS
3 Silencers	L03011

STONE THRESHOLD BY OTHER TRADES.

PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.

HW-MH6

Each Pair to Have:

RATED/NON-RATED

2 Continuous Hinges	X INTEGRAL HINGE GUARD CHANNEL
	X HOSPITAL TIP X ADJUSTA-SCREWS
2 Anti-Ligature Pulls (act. 1f)	
2 Manual Flush Bolts	L04251/L04261 (VERIFY)
1 Dust Proof Strike	L04021
1 Deadlatch	F30 LESS TRIM BOTH SIDES
1 Overlapping Astragal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Armor Plates	J101 X 0.050-INCH THICKNESS
2 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Floor Stops	L02121 X 3 FASTENERS
1 Threshold	J32300 X 2-1/4-INCH WIDTH
2 Auto Door Bottom	R0Y336 - HEAVY DUTY
1 Set Seals	R0Y164

PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.

HW-MH6A

Each Pair to Have:

NON-RATED/RATED

2 Continuous Hinge	X INTEGRAL HINGE GUARD CHANNEL
	X HOSPITAL TIP X ADJUSTA-SCREWS
2 Manual Flush Bolts	L04251/L04261 (VERIFY)
1 Dust Proof Strike	L04021
1 Passage Latch	F01 X LESS TRIM
1 Set Anti-Ligature Trim	
1 Overlapping Astragal	R0Y634 X R0Y154 X THROUGH-BOLTS
2 Armor Plate	J101 X 0.050-INCH THICKNESS
2 Edge Guard (at Wood Doors)	J208M/J211 (VERIFY), CUT: HARDWARE
2 Floor Stop	L02121 X 3 FASTENERS
1 Set Seals	R0Y164

PROVIDE SECURITY FASTENERS FOR ALL HARDWARE ITEMS.

NO CLOSER REQUIRED DUE TO EXEMPTION FOR PATIENT ROOM DOORS.

- - - E N D - - -

SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies glass-related glazing materials and accessories.
Glazing products specified apply to field-glazed items.

1.2 RELATED WORK

- A. Glazing in Hollow Metal Doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
B. Glazing in Wood Doors: Section 08 14 00, INTERIOR WOOD DOORS.
C. Glazing in Aluminum Doors and Storefront Applications: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
D. Glazing for Mirrors: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES.

1.3 LABELS

- A. Temporary Labels:
1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
3. Temporary labels shall remain intact until glass is approved by Contracting Officer's Representative (COR).
B. Permanent Labels:
1. Locate in corner for each pane.
2. Label in accordance with ANSI Z97.1 and SGCC (Safety Glass Certification Council) label requirements.
a. Tempered glass.
b. Laminated glass or have certificate for panes without permanent label.

1.4 PERFORMANCE REQUIREMENTS

- A. Glass Thickness: Thicknesses listed are minimums. Coordinate thicknesses with framing system manufacturers.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Warranty: Submit written guaranty, conforming to General Condition requirements, and to "Warranty of Construction" Article in this Section.
- C. Manufacturer's Literature and Data:
 - 1. Glass, each kind required.
 - 2. Elastic compound for metal sash glazing.
 - 3. Glazing cushion.
 - 4. Sealing compound.
- D. Samples:
 - 1. Size: 6 inches by 6 inches.
- E. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.
- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.
- D. Protect laminated safety glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location.
 - 1. Treat security glazing as fragile merchandise, and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling shall comply with manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.
 - 2. Temporary Protections: The glass front and back of glazing shall be temporarily protected with compatible, peelable, heat-resistant film

- which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination.
3. Edge Protection: To cushion and protect glass clad edges from contamination or foreign matter, the four edges shall be sealed the depth of glazing with continuous standard-thickness Santoprene tape. Alternatively, continuous channel-shaped extrusion of Santoprene shall be used, with flanges extending into face sides of glazing.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

1.8 WARRANTY

- A. Warranty: Conform to terms of "Warranty of Construction," FAR Clause 52.246-21, except extend warranty period for the following:
1. Laminated glass units are to remain laminated for 5 years.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
- Z97.1-09.....Safety Glazing Material Used in Building -
Safety Performance Specifications and Methods
of Test.
- C. American Society for Testing and Materials (ASTM):
- C542-05.....Lock-Strip Gaskets
- C716-06.....Installing Lock-Strip Gaskets and Infill
Glazing Materials
- C794-10.....Adhesion-in-Peel of Elastomeric Joint Sealants
- C864-05.....Dense Elastomeric Compression Seal Gaskets,
Setting Blocks, and Spacers
- C920-11.....Elastomeric Joint Sealants
- C964-07.....Standard Guide for Lock-Strip Gasket Glazing
- C1036-06.....Flat Glass
- C1048-12.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated
and Uncoated Glass.
- C1376-10.....Pyrolytic and Vacuum Deposition Coatings on
Flat Glass

- D635-10.....Rate of Burning and/or Extent and Time of
Burning of Self-Supporting Plastic in a
Horizontal Position
- D4802-10.....Poly (Methyl Methacrylate) Acrylic Plastic
Sheet
- E84-10.....Surface Burning Characteristics of Building
Materials
- E119-10.....Standard Test Methods for Fire Test of Building
Construction and Material
- E2190-10.....Insulating Glass Unit
- D. Commercial Item Description (CID):
- A-A-59502.....Plastic Sheet, Polycarbonate
- E. Code of Federal Regulations (CFR):
- 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 2010
- F. National Fire Protection Association (NFPA):
- 80-13.....Fire Doors and Windows
- 252-12.....Standard Method of Fire Test of Door Assemblies
- 257-12.....Standard on Fire Test for Window and Glass
Block Assemblies
- G. National Fenestration Rating Council (NFRC)
- H. Safety Glazing Certification Council (SGCC) 2012:
Certified Products Directory (Issued Semi-Annually)
- I. Underwriters Laboratories, Inc. (UL):
- 752-11.....Bullet-Resisting Equipment
- J. Unified Facilities Criteria (UFC):
- 4-010-01-2012.....DOD Minimum Antiterrorism Standards for
Buildings
- K. Glass Association of North America (GANA):
Glazing Manual (Latest Edition)
Sealant Manual (2009)
- L. American Society of Civil Engineers (ASCE):
ASCE 7-10.....Wind Load Provisions

PART 2 - PRODUCT

2.1 GLASS

- A. Use thickness stated unless specified otherwise in assemblies.
- B. Clear Glass:
1. ASTM C1036, Type I, Class 1, Quality q3.

2. Thickness, 1/4-inch.
3. Coordinate color/tint/coating to accommodate required security monitoring.

2.2 HEAT-TREATED GLASS

- A. Clear Tempered Glass:
1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
 2. Thickness, 1/4-inch.

2.3 LAMINATED GLASS

- A. Two or more lites of glass bonded with an interlayer material for use in building glazing
- B. Use 0.060-inch-thick interlayer for: Fully tempered glass assemblies.
- C. Use minimum 0.030-inch-thick interlayer for vertical glazing where 0.060-inch interlayer is not otherwise shown or required.

2.4 LAMINATED GLAZING ASSEMBLIES

- A. Clear Glazing:
1. Both panes clear glass ASTM C1036, Type I, Class 1, Quality q3.
 2. Thickness: Each pane, 1/8-inch thick.
- B. Clear Tempered Glazing:
1. Both panes ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
 2. Thickness: Each pane 3/16-inch thick.

2.5 GLAZING ACCESSORIES

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.
- B. Setting Blocks: ASTM C864:
1. Channel shape; having 1/4-inch internal depth.
 2. Shore A hardness of 80 to 90 Durometer.
 3. Block Lengths: 2 inches except 4 to 6 inches for insulating glass.
 4. Block Width: Approximately 1/6-inch less than the full width of the rabbet.
 5. Block Thickness: Minimum 3/16-inch. Thickness sized for rabbet depth as required.
- C. Spacers: ASTM C864:
1. Channel shape having a 1/4-inch internal depth.
 2. Flanges not less 3/32-inch-thick and web 1/8-inch thick.

3. Lengths: 1 to 3 inches.
 4. Shore A hardness of 40 to 50 Durometer.
- D. Sealing Tapes:
1. Semi-solid polymeric based material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
 2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
- E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.
- F. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbeted sash without stops.
- G. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular- or diamond-shaped pieces, 1/4-inch minimum size.
- H. Glazing Gaskets: ASTM C864:
1. Firm, dense, wedge shape for locking in sash.
 2. Soft, closed cell with locking key for sash key.
 3. Flanges may terminate above the glazing beads or terminate flush with top of beads.
- I. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.
- J. Glazing Sealants: ASTM C920, silicone neutral cure:
1. Type S.
 2. Class 25
 3. Grade NS.
 4. Shore A hardness of 25 to 30 Durometer.
- K. Structural Sealant: ASTM C920, silicone acetoxo cure:
1. Type S.
 2. Class 25.
 3. Grade NS.
 4. Shore A hardness of 25 to 30 Durometer.
- L. Neoprene, EPDM, or Vinyl Glazing Gasket: ASTM C864.
1. Channel shape; flanges may terminate above the glazing channel or flush with the top of the channel.
 2. Designed for dry glazing.

M. Color:

1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.
2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
2. Verify that glazing openings conform to details, dimensions and tolerances indicated on manufacturer's approved shop drawings.

B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation: Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

3.2 PREPARATION

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.
- C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.
- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION - GENERAL

- A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.

- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of Specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- F. Laminated Glass:
 - 1. Tape edges to seal interlayer and protect from glazing sealants.
 - 2. Do not use putty or glazing compounds.

3.4 REPLACEMENT AND CLEANING

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by Contracting Officer's Representative (COR).
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

3.5 PROTECTION

- A. Protect finished surfaces from damage during erection, and after completion of Work. Strippable plastic coatings on colored anodized finish are not acceptable.

3.6 GLAZING SCHEDULE

- A. Tempered Glass:
 - 1. Install in full and half-glazed doors unless indicated otherwise.
 - 2. Install in storefront, windows, and door sidelights adjacent to doors.
 - 3. Use clear tempered glass on interior sidelights and doors, and interior windows unless otherwise indicated or specified.

- - - E N D - - -

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies steel stud wall systems, shaft wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

1.2 RELATED WORK

- A. Load-Bearing Framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Support for Wall-Mounted Items: Section 05 50 00, METAL FABRICATIONS.
- C. Installation of Gypsum Board: Section 09 29 00, GYPSUM BOARD.
- D. Ceiling Suspension Systems for Acoustical Tile or Panels and Lay-In Gypsum Board Panels: Section 09 29 00, GYPSUM BOARD and Section 09 51 00, ACOUSTICAL CEILINGS.

1.3 TERMINOLOGY

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Studs, runners and accessories.
 - 2. Hanger inserts.
 - 3. Channels (rolled steel).
 - 4. Furring channels.
 - 5. Screws, clips and other fasteners.
- C. Shop Drawings:
 - 1. Typical ceiling suspension system.
 - 2. Typical metal stud and furring construction system including details around openings and corner details.

3. Typical shaft wall assembly.

4. Typical fire-rated assembly and column fireproofing showing details
of construction same as that used in fire rating test.

D. Test Results: Fire rating test designation, each fire rating required
for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

A. In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification to the
extent referenced. The publications are referenced in the text by the
basic designation only.

B. American Society For Testing And Materials (ASTM)

A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire

C11-10.....Terminology Relating to Gypsum and Related
Building Materials and Systems

C635-07.....Manufacture, Performance, and Testing of Metal
Suspension System for Acoustical Tile and Lay-in
Panel Ceilings

C636-08.....Installation of Metal Ceiling Suspension Systems
for Acoustical Tile and Lay-in Panels

C645-09.....Non-Structural Steel Framing Members

C754-11.....Installation of Steel Framing Members to Receive
Screw-Attached Gypsum Panel Products

C841-03 (R2008).....Installation of Interior Lathing and Furring

C954-10.....Steel Drill Screws for the Application of Gypsum
Panel Products or Metal Plaster Bases to Steel
Studs from 0.033-in. (0.84 mm) to 0.112-in.
(2.84 mm) in Thickness

E580-11.....Application of Ceiling Suspension Systems for
Acoustical Tile and Lay-in Panels in Areas
Requiring Moderate Seismic Restraint.

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

A. Galvanize steel studs, runners (track), rigid (hat section) furring
channels, "Z" shaped furring channels, and resilient furring channels,
with coating designation of G-60 minimum, per ASTM 123.

2.2 STEEL STUDS AND RUNNERS (TRACK)

A. ASTM C645, modified for thickness specified and sizes as shown.

1. Use ASTM A525 steel, 0.0359-inch-thick bare metal (20-gage), 4-inch studs.
2. Runners same thickness and size as studs.
- B. Provide not less than 2 cutouts in web of each stud, approximately 12 inches from each end, and intermediate cutouts on approximately 24-inch centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 12 feet or less in length shall be in one piece.
- E. Shaft Wall Framing:
 1. Conform to rated wall construction.
 2. C-H Studs.
 3. E Studs.
 4. J Runners.
 5. Steel jamb-strut.

2.3 FURRING CHANNELS

- A. Rigid Furring Channels (Hat Shape): ASTM C645.
- B. Resilient Furring Channels:
 1. Not less than 0.0179-inch-thick bare metal.
 2. Semi-hat shape, only 1 flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
- C. Rolled Steel Channels: ASTM C754, cold rolled; or ASTM C841, cold rolled.

2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

- A. ASTM C754, except as otherwise specified.
- B. For Fire-Rated Construction: Type and size same as used in fire rating test.
- C. Fasteners for Steel Studs Thicker Than 0.033-Inch Thick: Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Concrete Ceiling Hanger Inserts (Anchorage for Hanger Wire and Hanger Straps): Steel, zinc-coated (galvanized), manufacturer's standard items, designed to support twice the hanger loads imposed and the type of hanger used.

F. Tie Wire and Hanger Wire:

1. ASTM A641, soft temper, Class 1 coating.
2. Gage (diameter) as specified in ASTM C754 or ASTM C841.

G. Attachments for Wall Furring:

1. Manufacturer's standard items fabricated from zinc-coated (galvanized) steel sheet.
2. For Concrete or Masonry Walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 0.0396-inch-thick galvanized steel with corrugated edges.

H. Power-Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

- A. Where fire-rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.
- B. Construction requirements for fire-rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

- A. Install wall studs in accordance with ASTM C754. Use 20-gage, 4-inch studs unless otherwise shown on Drawings.
- B. Space studs as shown on Drawings, but not more than 24 inches on center.
- C. Cut studs 1/4- to 3/8-inch less than floor to underside of structure overhead when extended to underside of structure overhead.
- D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.
- E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound-rated partitions.
- F. Openings:
 1. Frame jambs of openings in stud partitions and furring with 2 studs placed back to back or as shown.
 2. Fasten back-to-back studs together with 3/8-inch-long Type S pan head screws at not less than 2 feet on center, staggered along webs.
 3. Studs fastened flange to flange shall have splice plates on both sides approximately 2 by 3 inches screwed to each stud with 2 screws in each stud. Locate splice plates at 24 inches on center between runner tracks.

G. Fastening Studs:

1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with 2 screws through each end of each stud and flange of runner.
2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

H. Chase Wall Partitions:

1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 2-1/2 inches wide.

I. Form control joint with double studs spaced 1/2-inch apart.

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. Wall Furring-Stud System:

1. Framed with 2-1/2-inch or narrower studs, 24 inches on center.
2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than 3-foot vertical intervals on side without finish.
3. Securely fasten braces to each stud with 2 Type S pan head screws at each bearing.

C. Direct Attachment to Masonry or Concrete; Rigid Channels:

1. Install rigid (hat section) furring channels at 24 inches on center, horizontally or vertically.
2. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
3. Ends of spliced furring channels shall be nested not less than 8 inches.
4. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide 2 fasteners in each flange.
5. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 4 inches of corner.

D. Installing Wall Furring-Bracket System: Space furring channels not more than 16 inches on center.

3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed-type plumbing fixture accessories, access panel frames, wall bumpers, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets, and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

3.5 INSTALLING SHAFT WALL SYSTEM

- A. Conform to UL Design U438 for 2-hour fire rating. Provide 2-hour fire-rated shaft walls where shown on Drawings.
- B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 24 inches on center.
- C. After liner panels have been erected, cut C-H studs and E studs, from 3/8-inch to not more than 1/2-inch less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.
- D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.
- E. Suitably frame all openings to maintain structural support for wall.
 - 1. Provide necessary liner fillers and shims to conform to label frame requirements.
 - 2. Frame openings cut within a liner panel with E studs around perimeter.
 - 3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

3.6 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS

- A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.
 - 1. Space framing at 16-inch centers for metal lath anchorage.
 - 2. Space framing at 24-inch centers for gypsum board anchorage.
- B. Where bar joists or beams are more than 48 inches apart, provide intermediate hangers so that spacing between supports does not exceed 48 inches. Use clips, bolts, or wire ties for direct attachment to steel framing.

C. Steel Decking Without Concrete Topping:

1. Do not fasten to steel decking 0.0299-inch or thinner.
2. Toggle bolt to decking 0.0359-inch or thicker only where anchorage to steel framing is not possible.

3.7 TOLERANCES

- A. Fastening surface for application of subsequent materials shall not vary more than 1/8-inch from the layout line.
- B. Plumb and align vertical members within 1/8-inch.
- C. Level or align ceilings within 1/8-inch.

- - - E N D - - -

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

- A. Installation of Steel Framing Members for Walls, Partitions, Furring, Soffits, and Ceilings: Section 05 40 00, COLD-FORMED METAL FRAMING, and Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.
- C. Gypsum Base for Veneer Plaster: Section 09 26 00, VENEER PLASTERING.

1.3 TERMINOLOGY

- A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.
- C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Cornerbead and edge trim.
 2. Finishing materials.
 3. Laminating adhesive.
 4. Gypsum board, each type.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

- A. In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

- A. In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing And Materials (ASTM):

- C11-08.....Terminology Relating to Gypsum and Related
Building Materials and Systems
- C475-02.....Joint Compound and Joint Tape for Finishing
Gypsum Board
- C840-08.....Application and Finishing of Gypsum Board
- C919-08.....Sealants in Acoustical Applications
- C954-07.....Steel Drill Screws for the Application of Gypsum
Board or Metal Plaster Bases to Steel Stud from
0.033 in. (0.84mm) to 0.112 in. (2.84mm) in
thickness
- C1002-07.....Steel Self-Piercing Tapping Screws for the
Application of Gypsum Panel Products or Metal
Plaster Bases to Wood Studs or Steel Studs
- C1047-05.....Accessories for Gypsum Wallboard and Gypsum
Veneer Base
- C1177-06.....Glass Mat Gypsum Substrate for Use as Sheathing
- C1658-06.....Glass Mat Gypsum Panels
- C1396-06.....Gypsum Board
- E84-08.....Surface Burning Characteristics of Building
Materials
- C. Underwriters Laboratories Inc. (UL):
Latest Edition.....Fire Resistance Directory
- D. Inchcape Testing Services (ITS):
Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

- A. Gypsum Board: ASTM C1396, Type X, 5/8-inch thick unless shown otherwise.
Shall contain a minimum of 20 percent recycled gypsum.
- B. Coreboard or Shaft Wall Liner Panels:
 - 1. ASTM C1396, Type X.
 - 2. ASTM C1658: Glass Mat Gypsum Panels, Type X.
 - 3. Coreboard for shaft walls 12, 16, or 24 inches wide by required
lengths 1 inch thick with paper faces treated to resist moisture.
- C. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 5/8-inch thick.
- D. Gypsum cores shall contain maximum percentage of post industrial
recycled gypsum content available in the area (a minimum of 95 percent
post industrial recycled gypsum content). Paper facings shall contain
100 percent post-consumer recycled paper content.

2.2 GYPSUM SHEATHING BOARD

- A. ASTM C1396, Type X, water-resistant core, 5/8-inch thick.
- B. ASTM C1177, Type X.

2.3 ACCESSORIES

- A. ASTM C1047, except form of 0.015-inch-thick zinc-coated steel sheet or rigid PVC plastic.
- B. Flanges not less than 7/8-inch wide with punchouts or deformations as required to provide compound bond.

2.4 FASTENERS

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.33-inch.
- C. Select screws of size and type recommended by the manufacturer of the material being fastened.
- D. For fire-rated construction, type and size same as used in fire rating test.
- E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

- A. ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

- A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:
 - 1. Two sides of partitions:
 - a. Fire-rated partitions.
 - b. Smoke partitions.
 - c. Sound-rated partitions.
 - d. Full height partitions (FHP) shown.
 - e. Corridor partitions.
 - 2. One side of partitions or furring:
 - a. Inside of exterior wall furring or stud construction.
 - b. Room side of room without suspended ceilings.
 - c. Furring for pipes and duct shafts, except where fire-rated shaft wall construction is shown.

3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.
- B. In locations other than those specified, extend gypsum board from floor to heights as follows:
 1. Not less than 4 inches above suspended acoustical ceilings.
 2. At ceiling of suspended gypsum board ceilings.
 3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

- A. Coordinate installation of gypsum board with other trades and related work.
- B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- C. Moisture- and Mold-Resistant Assemblies: Provide and install moisture- and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.
- D. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- E. Bring gypsum board into contact, but do not force into place.
- F. Ceilings:
 1. For single-ply construction, use perpendicular application.
 2. For two-ply assemblies:
 - a. Use perpendicular application.
 - b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.
- G. Walls (Except Shaft Walls):
 1. When gypsum board is installed parallel to framing members, space fasteners 12 inches on center in field of the board, and 8 inches on center along edges.
 2. When gypsum board is installed perpendicular to framing members, space fasteners 12 inches on center in field and along edges.
 3. Stagger screws on abutting edges or ends.
 4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints.
 5. For 2-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of

- wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. For 3-ply gypsum board assemblies, apply plies in same manner as for 2-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of 2-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for 2-ply assemblies.
 7. No offset in exposed face of walls and partitions will be permitted because of single-ply and 2-ply or 3-ply application requirements.
 8. Control Joints ASTM C840 and As Follows:
 - a. Locate at both side jambs of openings if gypsum board is not "yoked." Use one system throughout.
 - b. Not required for wall lengths less than 30 feet.
 - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- H. Acoustical or Sound-Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 1/8- to 1/4-inch wide around partition perimeter.
 2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
 3. For sound-rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.
- I. Electrical and Telecommunications Boxes: Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.
- J. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
 2. Install in 1 piece, without the limits of the longest commercially available lengths.
 3. Corner Beads:
 - a. Install at all vertical and horizontal external corners and where shown.
 - b. Use screws only. Do not use crimping tool.

4. Edge Trim (Casings Beads):

- a. At both sides of expansion and control joints unless shown otherwise.
- b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
- c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
- d. Where shown.

3.3 INSTALLING GYPSUM SHEATHING

- A. Install in accordance with ASTM C840, except as otherwise specified or shown.
- B. Use screws of sufficient length to secure sheathing to framing.
- C. Space screws 3/8-inch from ends and edges of sheathing and 8 inches on center. Space screws a maximum of 8 inches on center on intermediate framing members.
- D. Apply 2-foot by 8-foot sheathing boards horizontally with tongue edge up.
- E. Apply 4-foot by 8- or 9-foot gypsum sheathing boards vertically with edges over framing.

3.4 CAVITY SHAFT WALL

- A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.
- B. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR (Non-bearing for 2-hour fire rating. Conform to FM WALL CONSTRUCTION 25-1/HR (Non-load-bearing) for 1-hour fire rating where shown.
- C. Cut coreboard (liner) panels 1 inch less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
 1. Where shaft walls exceed 14 feet in height, position panel end joints within upper and lower third points of wall.
 2. Stagger joints top and bottom in adjacent panels.
 3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 12 inches on center.
- D. Gypsum Board:
 1. Two-Hour Wall:
 - a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 1-inch-long screws, spaced 24 inches on center.

- b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
- c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 12 inches on center.
- 2. One-Hour Wall With 1 Layer on Finish Side of Wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 12 inches on center in field and along edges.
- 3. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.
- E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

3.5 FINISHING OF GYPSUM BOARD

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to public view, except use Level 5 behind reception desk for mural application as shown on Drawings.
- B. Before proceeding with installation of finishing materials, assure the following:
 - 1. Gypsum board is fastened and held close to framing or furring.
 - 2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
- C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non-decorated smoke barrier, fire-rated and sound-rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier, fire-rated and sound-rated construction. Sanding is not required of non-decorated surfaces.

3.6 REPAIRS

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.
- B. Patch holes or openings 1/2-inch or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

- C. Repair holes or openings over 1/2-inch diameter, or equivalent size, with 5/8-inch-thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke-tight construction, fire protection equivalent to the fire-rated construction, and STC equivalent to the sound-rated construction.

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SECTION 09 30 13
PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies porcelain tile, waterproofing membranes for thin-set applications, crack isolation membranes, and tile backer board.

1.2 RELATED WORK

- A. Sealing of Joints where Specified: Section 07 92 00, JOINT SEALANTS.
- B. Color, texture and pattern of field tile and trim shapes, size of field tile, trim shapes, and color of grout as indicated in the Finish Schedule on the Drawings.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
1. Base tile, each type, each color, each size.
 2. Paver tile, each size, type, color and pattern.
 3. Porcelain tile, each type, color, pattern and size.
 4. Wall (or wainscot) tile, each color, size and pattern.
 5. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.
- C. Product Data:
1. Porcelain tile, marked to show each type, size, and shape required.
 2. Cementitious backer unit.
 3. Dry-set Portland cement mortar and grout.
 4. Elastomeric membrane and bond coat.
 5. Reinforcing tape.
 6. Leveling compound.
 7. Latex-Portland cement mortar and grout.
 8. Commercial Portland cement grout.
 9. Slip resistant tile.
 10. Waterproofing isolation membrane.
 11. Fasteners.
- D. Certification:
1. Master grade, ANSI A137.1.
 2. Manufacturer's certificates indicating that the following materials comply with Specification requirements:

- a. Chemical-resistant mortar and grout (epoxy and furan).
- b. Modified epoxy emulsion.
- c. Commercial Portland cement grout.
- d. Cementitious backer unit.
- e. Dry-set Portland cement mortar and grout.
- f. Elastomeric membrane and bond coat.
- g. Reinforcing tape.
- h. Latex-Portland cement mortar and grout.
- i. Leveling compound.
- j. Waterproof isolation membrane.
- k. Factory-mounted tile suitability for application in wet area specified under 2.1,A.,3. with list of successful in-service performance locations.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
 - A108.1A-11.....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
 - A108.1B-11.....Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar
 - A108.1C-11.....Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar
 - A137.1-08.....Ceramic Tile
- C. American Society For Testing And Materials (ASTM):
 - A185-07.....Steel Welded Wire Fabric, Plain, for Concrete Reinforcing
 - C109/C109M-11.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)

C241-09.....	Abrasion Resistance of Stone Subjected to Foot Traffic
C348-08.....	Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
C627-10.....	Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
C954-11.....	Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness
C979-10.....	Pigments for Integrally Colored Concrete
C1002-07.....	Steel Self-Piercing Tapping Screws for the Application of Panel Products
C1027-09.....	Determining "Visible Abrasion Resistance on Glazed Ceramic Tile"
C1028-07.....	Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method
C1127-09.....	Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface
C1178/C1178M-11.....	Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
C1325-08.....	Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
D4397-10.....	Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
D5109-99 (R2004).....	Standard Test Methods for Copper-Clad Thermosetting Laminates for Printed Wiring Boards

D. Tile Council of America, Inc. (TCA):
2007.....Handbook for Ceramic Tile Installation

PART 2 - PRODUCTS

2.1 TILE

- A. Comply with ANSI A137.1, Standard Grade, except as modified.
 - 1. Inspection procedures listed under the Appendix of ANSI A137.1.
 - 2. Abrasion Resistance Classification:
 - a. Tested in accordance with values listed in Table 1, ASTM C1027.

- b. Class V, 12,000 revolutions for floors in corridors, kitchens, storage including refrigerated rooms
 - c. Class IV, 6,000 revolutions for remaining areas.
- 3. Slip-Resistant Tile for Floors:
 - a. Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance:
 - 1) Not less than 0.7 (wet condition) for bathing areas.
 - 2) Not less than 0.8 on ramps for wet and dry conditions.
 - 3) Not less than 0.6, except 0.8 on ramps as stated above, for wet and dry conditions for other areas.
 - b. Porcelain Paver Tile: Matte surface finish with raised ridges spaced uniformly over tile surface.
- 4. Do not use back-mounted tiles in showers unless certified by manufacturer as noted in paragraph 1.3,D.
- 5. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
- 6. Factory-Applied Temporary Protective Coating:
 - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
 - b. Do not coat unexposed tile surfaces.
 - c. Pre-wax tiles set or grouted with latex modified mortars.
- B. Glazed Wall Tile: Cushion edges, glazing, as indicated in the Finish Schedule on the Drawings.
- C. Porcelain Paver Tile: Nominal 5/16-inch thick, with cushion edges. Porcelain tile produced by the dust pressed method shall be made of approximately 50 percent feldspar; the remaining 50 percent shall be made up of various high-quality light-firing ball clays yielding a tile with a water absorption rate of 0.5 percent or less and a breaking strength of between 390 to 400 pounds.
- D. Trim Shapes:
 - 1. Conform to applicable requirements of adjoining floor and wall tile.
 - 2. Use slip-resistant trim shapes for horizontal surfaces of showers, overflow ledges, recessed steps, shower curbs, drying area curbs, and seats.

3. Use trim shapes sizes conforming to size of adjoining field wall tile including existing spaces unless detailed or indicated otherwise in the Finish Schedule on the Drawings.
4. Internal and External Corners:
 - a. Square internal and external corner joints are not acceptable.
 - b. External Corners Including Edges: Use bullnose shapes.
 - c. Internal Corners: Use cove shapes.
 - d. Base to Floor Internal Corners: Use special shapes providing integral cove vertical and horizontal joint.
 - e. Base to Floor External Corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
 - f. Wall Top Edge Internal Corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
 - g. Wall Top Edge External Corners: Use special shapes providing bullnose vertical and horizontal joint edge.
 - h. For glazed wall tile installed in Portland cement mortar setting bed, use cove and bullnose shapes as applicable.
 - i. For glazed wall tile installed in dry-set Portland cement mortar, latex-Portland cement mortar (thin set methods), use cove and surface bullnose shapes as applicable.

2.2 CEMENTITIOUS BACKER UNITS

- A. Use in showers or wet areas.
- B. ASTM C1325.
- C. Use cementitious backer units in maximum available lengths.

2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 2 inches wide. Tape with pressure-sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A108.1.
- C. Joint material, including reinforcing tape, and tape embedding material, shall be as specifically recommended by the backer unit manufacturer.

2.4 FASTENERS

- A. Screws for Cementitious Backer Units.
 1. Standard screws for gypsum board are not acceptable.
 2. Minimum 7/16-inch-diameter head, corrosion-resistant coated, with washers.
 3. ASTM C954 for steel 0.033-inch thick.

4. ASTM C1002 for steel framing less than 0.0329-inch thick.

B. Washers: Galvanized steel, 1/2-inch minimum diameter.

2.5 GLASS MAT WATER RESISTANT GYPSUM BACKER BOARD

A. Conform to ASTM C1178/C1178M, Optional System for Cementitious Backer Units where shown on Drawings.

2.6 SETTING MATERIALS OR BOND COATS

A. Conform to TCA Handbook for Ceramic Tile Installation.

B. Portland Cement Mortar: ANSI A108.1.

C. Latex-Portland Cement Mortar: ANSI A108.1.

1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A108.1.

2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

D. Dry-Set Portland Cement Mortar: ANSI A108.1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A108.4.

E. Elastomeric Waterproofing Membrane and Bond Coat:

1. TCA F122-02.

2. ANSI A108.1.

3. One-component polyurethane, liquid-applied material having the following additional physical properties:

a. Hardness: Shore "A" between 40 and 60.

b. Elongation: Between 300 and 600 percent.

c. Tensile strength: Between 40 and 60 psig.

d. No volatile compounds.

4. Coal tar modified urethanes are not acceptable.

F. Waterproofing Isolation Membrane:

1. Sheet System TCA F122-02.

2. Optional system to elastomeric waterproof membrane.

3. Composite sheet consisting of ASTM D5109, Type II, Grade I Chlorinated Polyethylene (CM) sheet reinforced on both sides with a non-woven polyester fiber.

4. Designed for use in wet areas as an isolation and positive waterproofing membranes for thin-set bonding of sheet to substrate and thin-set bonding of ceramic and porcelain tile or marble to sheet. Suited for both horizontal and vertical applications.

5. Conform to the following additional physical properties:

Property	Units	Results	Test Method
Hardness Shore A	Points	70-80	ASTM D2240 (10 Second Reading)
Shrinkage	Percent	5 maximum	ASTM D1204
Brittleness		No crack remains flexible at temperature -25 degrees F	ASTM D2497 1/2- inch Mandrel Bend
Retention of Properties after Heat Aging	Percent of original	80 Tensile 80 Breaking 80 Elongation	ASTM D3045, 194 degrees F for 168 hours

6. Manufacturer's standard sheet size with prefabricated or preformed inside and outside corners.
7. Sheet manufacturer's solvent welding liquid or xylene and edge sealant.

2.7 GROUTING MATERIALS

A. Coloring Pigments:

1. Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
2. Add coloring pigments to grout by the manufacturer.
3. Job-colored grout is not acceptable.
4. Use is required in commercial Portland cement grout, dry-set grout, and latex-Portland cement grout.

B. White Portland Cement Grout:

1. ANSI A108.1.
2. Use 1 part white Portland cement to 1 part white sand passing a Number 30 screen.
3. Color additive not permitted.

C. Commercial Portland Cement Grout: ANSI A108.1, color as specified.

D. Dry-Set Grout: ANSI A108.1, color as specified.

E. Latex-Portland Cement Grout: ANSI A108.1, color as specified.

1. Unsanded grout mixture for joints 1/8-inch and narrower.
2. Sanded grout mixture for joints 1/8-inch and wider.

F. Chemical-Resistant Grout: Epoxy grout, ANSI A108.1.

2.8 PATCHING AND LEVELING COMPOUND

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Shall have minimum following physical properties:
 - 1. Compressive Strength: 3,500 psig per ASTM C109/C109M.
 - 2. Flexural Strength: 1,000 psig per ASTM C348 (28-day value).
 - 3. Tensile Strength: 600 psi per ANSI 118.7.
 - 4. Density: 1.9.
- C. Capable of being applied in layers up to 1-1/2 inches thick without fillers and up to 4 inches thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.
- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
- E. Ready for use in 48 hours after application.

2.9 WATER

- A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.10 CLEANING COMPOUNDS

- A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- B. Materials containing acid or caustic material not acceptable.

2.11 FLOOR MORTAR BED REINFORCING

- A. ASTM A185 welded wire fabric without backing, MW3 x MW3 (2 x 2-W0.5 x W0.5).

2.12 POLYETHYLENE SHEET

- A. Polyethylene sheet conforming to ASTM D4397.
- B. Nominal Thickness: 6 mils.
- C. Use sheet width to minimize joints.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature of work areas at not less than 60 degrees F, without interruption, for not less than 24 hours before installation and not less than three days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.

- C. Do not install tile when the temperature is above 100 degrees F.
- D. Do not install materials when the temperature of the substrate is below 60 degrees F.
- E. Do not allow temperature to fall below 50 degrees F after fourth day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
 - 1. Not more than 1/4-inch in 10 feet from required elevation where Portland cement mortar setting bed is used.
 - 2. Not more than 1/8-inch in 10 feet where dry-set Portland cement and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.
- B. Variation in Plane of Wall Surfaces:
 - 1. Not more than 1/4-inch in 8 feet from required plane where Portland cement mortar setting bed is used.
 - 2. Not more than 1/8-inch in 8 feet where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION

- A. Cleaning New Concrete or Masonry:
 - 1. Chip out loose material, clean off all oil, grease, dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.
 - 2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
 - 3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.
- B. Patching and Leveling:
 - 1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
 - 2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
 - a. Thickness of compound as required to bring finish tile system to elevation shown.
 - b. Float finish except finish smooth for elastomeric waterproofing.

- c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
 3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
 4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
- C. Mortar Bed for Slopes to Drains:
1. Slope compound to drain where drains are shown.
 2. Install mortar bed in depressed slab sloped to drains not less than 1/16-inch per foot.
 3. Allow not less than 2-inch depression at edge of depressed slab.
 4. Screed for slope to drain and float finish.
 5. Cure mortar bed for not less than 7 days. Do not use curing compounds or coatings.
- D. Cleavage Membrane:
1. Install polythene sheet as cleavage membrane in depressed slab when waterproof membrane is not scheduled or indicated.
 2. Turn up at edge of depressed floor slab to top of floor.
- E. Walls:
1. In showers or other wet areas cover studs with polyethylene sheet.
 2. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
 3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
- F. Existing Floors and Walls:
1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.
 2. Remove existing concrete fill or topping to structural slab. Clean and level the substrate for new setting bed and waterproof membrane or cleavage membrane.
 3. Where new tile bases are required to finish flush with plaster above or where they are extensions of similar bases in conjunction with existing floor tiles, cut channel in floor slab and expose rough wall

construction sufficiently to accommodate new tile base and setting material.

3.4 CEMENTITIOUS BACKER UNITS

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A108.1 except as specified otherwise.
- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a V joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 8 inches on center and not closer than 1/2-inch from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.
- E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top 1 inch of turned up waterproof systems.
- F. Do not install joint treatment for 7 days after installation of cementitious backer unit.
- G. Joint Treatment:
 - 1. Fill horizontal and vertical joints and corners with latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
 - 2. Leave 1/4-inch space for sealant at lips of tubs, sinks, or other plumbing receptors.

3.5 GLASS MAT WATER-RESISTANT GYPSUM BACKER BOARD

- A. Install in accordance with manufacturer's instructions. TCA Systems W245-01.
- B. Treat joints with tape and latex-Portland cement mortar or adhesive.

3.6 CERAMIC TILE - GENERAL

- A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.
- B. Comply with TCA Installation Guidelines:
- C. Installing Mortar Beds for Floors:
 - 1. Install mortar bed to not damage cleavage or waterproof membrane; 1-1/2-inch minimum thickness.

2. Install floor mortar bed reinforcing centered in mortar fill.
3. Screed finish to level plane or slope to drains where shown, float finish.
4. For thin set systems cure mortar bed not less than 7 days. Do not use curing compounds or coatings.
5. For tile set with Portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.

D. Setting Beds or Bond Coats:

1. Where recessed or depressed floor slabs are filled with Portland cement mortar bed, set ceramic mosaic floor tile in either Portland cement paste over plastic mortar bed or latex-Portland cement mortar over cured mortar bed except as specified otherwise, ANSI A108-1C, TCA System F121-02 or F111-02.
2. Set floor tile in elastomeric bond coat over elastomeric membrane ANSI 108. 13, TCA System F122 where scheduled and where shown.
3. Set wall tile installed over concrete or masonry in dry-set Portland cement mortar, or latex-Portland cement mortar, ANSI 108.1B.and TCA System W211-02, W221-02 or W222-02.
4. Set wall tile installed over concrete backer board in latex-Portland cement mortar, ANSI A108.1B.
5. Set trim shapes in same material specified for setting adjoining tile.

E. Workmanship:

1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field. Align new tile work scheduled for existing spaces to the existing tile work unless specified otherwise.
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise.
3. Form intersections and returns accurately.
4. Cut and drill tile neatly without marring surface.
5. Cut edges of tile abutting penetrations, finish, or built-in items:
 - a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
 - b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.

6. Completed work shall be free from hollow sounding areas and loose, cracked or defective tile.
7. Remove and reset tiles that are out of plane or misaligned.
8. Floors:
 - a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
 - b. Align finish surface of new tile work flush with other and existing adjoining floor finish where shown.
 - c. In areas where floor drains occur, slope to drains where shown.
 - d. Shove and vibrate tiles over 8 inches square to achieve full support of bond coat.
9. Walls:
 - a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights shown with tile.
 - b. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
10. Joints:
 - a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
 - b. Make joints 1/16-inch wide for glazed wall tile and mosaic tile work.
 - c. Make joints in paver tile, porcelain type, maximum 1/8-inch wide.
11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
 - a. Tile wall installations in wet areas, including showers.
 - b. Tile wall installations composed of tiles 8 by 8 inches or larger.
 - c. Exterior tile wall installations.

3.7 CERAMIC TILE INSTALLED WITH PORTLAND CEMENT MORTAR

- A. Mortar Mixes for Floor, Wall and Base Tile (including Showers): ANSI A108.1. except specified otherwise.
- B. Installing Wall and Base Tile: ANSI A108.1, except specified otherwise.
- C. Installing Floor Tile: ANSI A108.1, except as specified otherwise. Slope mortar beds to floor drains a minimum of 1/8-inch per foot.

3.8 PORCELAIN TILE INSTALLED WITH LATEX PORTLAND CEMENT BONDING MORTAR

- A. Due to the denseness of porcelain tile use latex-Portland cement bonding mortar that meets the requirements of ANSI A108.1. Bonding mortars shall be mixed in accordance with manufacturer's instructions. Improper liquid ratios and dwell time before placement of bonding mortar and tile shall affect bond.

3.9 THIN-SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR

- A. Installation of Tile: ANSI A108.1, except as specified otherwise.
- B. Slope tile work to drains not less than 1/8-inch per foot.

3.10 CERAMIC AND PORCELAIN TILE INSTALLED WITH ELASTOMERIC BOND COAT

- A. Surface Preparation: Prepare surfaces as specified in paragraph 3.3,G.
- B. Installation of Elastomeric Membrane: ANSI A108.1 and TCA F122-02.
 - 1. Prime surfaces, where required, in accordance with manufacturer's instructions.
 - 2. Install first coat of membrane material in accordance with manufacturer's instructions, in thickness of 30 to 50 mils.
 - 3. Extend material over flashing rings of drains and turn up vertical surfaces not less than 4 inches above finish floor surface.
 - 4. When material has set, recoat areas with a second coat of elastomeric membrane material for a total thickness of 50 to 75 mils.
 - 5. After curing test for leaks with 1 inch of water for 24 hours.
- C. Installation of Tile in Elastomeric Membrane:
 - 1. Spread no more material than can be covered with tile before material starts to set.
 - 2. Apply tile in second coat of elastomeric membrane material in accordance with the coating manufacturer's instructions in lieu at aggregate surfacing specified in ASTM C1127. Do not install top coat over tile.

3.11 GROUTING

- A. Grout Type and Location:
 - 1. Grout for Glazed Wall: Portland cement grout, latex-Portland cement grout, dry-set grout, or commercial Portland cement grout.
 - 2. Grout for Base Tile, Floor Tile, and Paver Tile: Epoxy grout.
- B. Workmanship:
 - 1. Install and cure grout in accordance with the applicable standard.
 - 2. Portland Cement Grout: ANSI A108.1.
 - 3. Dry-Set Grout: ANSI A108.1.

3.12 MOVEMENT JOINTS

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.
- B. TCA details EJ 171-02.
- C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.
- D. Rake out grout at joints between tile, where shown, not less than 1/4-inch deep.

3.13 CLEANING

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used shall not damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with commercial Portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

3.14 PROTECTION

- A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.
- B. Where traffic occurs over tile floor, cover tile floor with not less than 3/8-inch-thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

3.15 TESTING FINISH FLOOR

- A. Test floors in accordance with ASTM C627 to show compliance with Codes 1 through 10.

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SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.

1.2 RELATED WORK

- A. Color, Pattern, and Location of Each Type of Acoustical Unit: Refer to the Finish Schedule on the Drawings.
- B. HVAC: Section 23 37 00, AIR OUTLETS AND INLETS.
- C. Lighting: Section 26 51 00, INTERIOR LIGHTING.

1.3 SUBMITTAL

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Acoustical units, each type, with label indicating conformance to Specification requirements, including units specified to match existing.
 - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
 - 1. Ceiling suspension system, each type, showing complete details of installation, including suspension system specified to match existing and upward access system details for concealed grid systems.
 - 2. Acoustical units, each type
- D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

1.4 DEFINITIONS

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM E1264.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A641/A641M-03.....Zinc-coated (Galvanized) Carbon Steel Wire
 - A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process

C423-07.....	Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
C634-02 (E2007).....	Standard Terminology Relating to Environmental Acoustics
C635-04.....	Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
C636-06.....	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
E84-07.....	Surface Burning Characteristics of Building Materials
E119-07.....	Fire Tests of Building Construction and Materials
E413-04.....	Classification for Rating Sound Insulation
E580-06.....	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
E1264-(R2005).....	Classification for Acoustical Ceiling Products

PART 2 - PRODUCTS

2.1 METAL SUSPENSION SYSTEM

- A. ASTM C635, heavy-duty system, except as otherwise specified.
 - 1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
 - a. Galvanized cold-rolled steel, bonderized.
 - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
 - 3. Use aluminum face covers in toilets adjacent to shower areas.
- B. Exposed Grid Suspension System for Support of Lay-In Panels:
 - 1. Exposed grid width not less than 7/8-inch with not less than 5/16-inch panel bearing surface.
 - 2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
 - 3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless indicated otherwise in the Finish Schedule on the Drawings.

2.2 PERIMETER SEAL

- A. Vinyl, polyethylene or polyurethane open-cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure-sensitive adhesive coating on one side.

- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 3/8-inch-wide strip.

2.3 WIRE

- A. ASTM A641.
- B. For Wire Hangers: Minimum diameter 0.1055-inch.
- C. For Bracing Wires: Minimum diameter 0.1350-inch.

2.4 ANCHORS AND INSERTS

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. Hanger Inserts: Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
- C. Clips:
 - 1. Galvanized steel.
 - 2. Designed to clamp to steel beam or bar joists, or secure framing member together.
 - 3. Designed to rigidly secure framing members together.
 - 4. Designed to sustain twice the loads imposed by hangers or items supported.

2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 1,000 linear feet:

Size Inches	Cold-rolled Pounds	Hot-rolled Pounds
1-1/2	475	1,120
2	590	1,260

2.6 ACOUSTICAL UNITS

- A. General:
 - 1. Ceiling tile shall meet minimum 37 percent bio-based content in accordance with USDA Bio-Preferred Product requirements.
 - 2. ASTM E1264, weighing 3/4-psf minimum for mineral fiber panels or tile.
 - 3. Class A Flame Spread: ASTM 84.
 - 4. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
 - 5. Minimum CAC (Ceiling Attenuation Class): 40 to 44 range unless specified otherwise: ASTM E413.

6. Manufacturer's standard finish, minimum light reflectance (LR) coefficient of 0.75 on the exposed surfaces, except as indicated in the Finish Schedule on the Drawings.
7. Lay-in Panels: Sizes as shown, with square edges or reveal edges, as applicable per the Finish Schedule on the Drawings.
- B. Type III Units: Mineral base with water-based painted finish less than 10 g/l VOC, Form 2 - Water felted, minimum 5/8-inch thick. Mineral base to contain minimum 65 percent recycled content.
- C. Type IV Units - Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 5/8-inch thick. Apply over the paint coat on the face of the unit a poly (vinyl) chloride overspray having a flame spread index of 25 or less when tested in accordance with ASTM E84.

2.7 ACCESS IDENTIFICATION

- A. Markers:
 1. Use colored markers with pressure-sensitive adhesive on one side.
 2. Make colored markers of paper or plastic, 1/4- to 3/8-inch in diameter.
- B. Use markers of the same diameter throughout building.
- C. Color Code: Use following color markers for service identification:

Color.....	Service
Red.....	Sprinkler System: Valves and Controls
Green.....	Domestic Water: Valves and Controls
Yellow.....	Chilled Water and Heating Water
Orange.....	Ductwork: Fire Dampers
Blue.....	Ductwork: Dampers and Controls
Black.....	Gas: Laboratory, Medical, Air and Vacuum

PART 3 - EXECUTION

3.1 CEILING TREATMENT

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 24 inches wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.
- B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.
- C. Moldings:
 1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.

2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.

D. Perimeter Seal:

1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

E. Existing Ceiling:

1. Where extension of existing ceilings occurs, match existing.
2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

3.2 CEILING SUSPENSION SYSTEM INSTALLATION

A. General:

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 16 square feet of ceiling per hanger.
4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
5. Provide extra hangers, minimum of 1 hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 4-inch clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 48 inches in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Anchorage to Structure:

1. Steel:

- a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.

- (1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
 - (2) Attach hangers to steel carrying channels, spaced 4 feet on center, unless area supported or deflection exceeds the amount specified.
 - b. Attach carrying channels to the bottom flange of steel beams spaced not 4 feet on center before fireproofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
 - c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.
- C. Direct-Hung Suspension System:
1. As illustrated in ASTM C635.
 2. Support main runners by hanger wires attached directly to the structure overhead.
 3. Maximum spacing of hangers 4 feet on centers unless interference occurs by mechanical systems. Use indirect-hung suspension system where not possible to maintain hanger spacing.
- D. Indirect-Hung Suspension System:
1. As illustrated in ASTM C635.
 2. Space carrying channels for indirect hung suspension system not more than 4 feet on center. Space hangers for carrying channels not more than 8 feet on center or for carrying channels less than 4 feet on center so as to insure that specified requirements are not exceeded.
 3. Support main runners by specially designed clips attached to carrying channels.

3.3 ACOUSTICAL UNIT INSTALLATION

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 1/4-inch bearing at edges on supports.
 1. Install tile to lay level and in full contact with exposed grid.
 2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.
- C. Markers:
 1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.

2. Attach colored markers to exposed grid on opposite sides of the units providing access.

3.4 CLEANUP AND COMPLETION

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects.
- C. Vacuum tiles prior to final inspection.

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**SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the installation of vinyl or rubber base and resilient stair treads with sheet rubber flooring on landings.

1.2 RELATED WORK

- A. Color and Texture: See the Finish Schedule on the Drawings.
- B. Sheet Flooring: Section 09 65 16, RESILIENT SHEET FLOORING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Base material manufacturer's recommendations for adhesives.
 - 3. Application and installation instructions.
- C. Samples:
 - 1. Base: 6 inches long, each type and color.
 - 2. Adhesive: Literature indicating each type.

1.4 DELIVERY

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

- A. Store materials in weather tight and dry storage facility.
- B. Protect material from damage by handling and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - F1861-08.....Resilient Wall Base

PART 2 - PRODUCTS

2.1 GENERAL

- A. Use only products by the same manufacturer and from the same production run.

2.2 RESILIENT BASE

- A. ASTM F1861, 1/8-inch thick, 4 inches high, Thermoplastics, Group 2-layered. Style B-cove.
- B. Use only one type of base throughout.

2.3 PRIMER (FOR CONCRETE FLOORS)

- A. As recommended by the adhesive and tile manufacturer.

2.4 LEVELING COMPOUND (FOR CONCRETE FLOORS)

- A. Provide products with latex or polyvinyl acetate resins in the mix.

2.5 ADHESIVES

- A. Use products recommended by the material manufacturer for the conditions of use.
- B. Use low-VOC adhesive during installation. Water-based adhesive with low VOC is preferred over solvent based adhesive.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain temperature of materials above 70 degrees F for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs, between 70 and 80 degrees F) for at least 48 hours, before, during, and after installation.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

3.2 INSTALLATION REQUIREMENTS

- A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the Contracting Officer's Representative (COR).
- B. Submit proposed installation deviation from this Specification to the COR indicating the differences in the method of installation.
- C. The COR reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

3.3 PREPARATION

- A. Examine surfaces on which material is to be installed.

- B. Fill cracks, pits, and dents with leveling compound.
- C. Level to 1/8-inch maximum variations.
- D. Do not use adhesive for leveling or filling.
- E. Grind, sand, or cut away protrusions; grind high spots.
- F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.
- G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.
- H. Preparation of existing installation:
 - 1. Remove existing base including adhesive.
 - 2. Do not use solvents to remove adhesives.
 - 3. Prepare substrate as specified.

3.4 BASE INSTALLATION

- A. Location:
 - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, laboratory, pharmacy furniture island cabinets and where other equipment occurs.
 - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
 - 1. Apply adhesive uniformly with no bare spots.
 - 2. Set base with joints aligned and butted to touch for entire height.
 - 3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 24 inches in length.
 - a. Short pieces to save material will not be permitted.
 - b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.
- C. Form corners and end stops as follows:
 - 1. Score back of outside corner.
 - 2. Score face of inside corner and notch cove.
- D. Roll base for complete adhesion.

3.5 CLEANING AND PROTECTION

- A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.

- B. Keep traffic off resilient material for at least 72 hours after installation.
- C. Clean and polish materials in the following order:
 - 1. After 2 weeks, scrub resilient base material with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.
- D. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

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SECTION 09 65 16
RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the installation of sheet flooring.
- B. Grades of resilient sheet vinyl floor covering without backing having vinyl plastic wearlayer with backing.
- C. Installation of sheet flooring including the following:
 - 1. Heat welded seams.

1.2 RELATED WORK

- A. Concrete Floors: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Color, Pattern and Texture: As shown on the Finish Schedule on the Drawings.
- C. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 QUALITY CONTROL QUALIFICATIONS

- A. The Contracting Officer shall approve products or service of proposed manufacturer, suppliers, and installers, and the Contractor shall submit certification that:
 - 1. Heat-welded seaming is manufacturer's prescribed method of installation.
 - 2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
 - 3. Manufacturer's product submitted has been in satisfactory operation on 3 installations similar and equivalent in size to this Project for 3 years. Submit list of installations.
- B. The sheet vinyl floor coverings shall meet fire performance characteristics as determined by testing products, per ASTM test method, indicated below by Underwriters Laboratories, Inc. (UL) or another recognized testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45-watts per sq. cm or more, Class I, per ASTM E648.
 - 2. Smoke Density: Less than 450 per ASTM E662.
- C. The floor covering manufacturer shall certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOCs).

1.4 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, submit following:
- B. Manufacturer's Literature and Data:
 - 1. Description of resilient material and accessories to be provided.
 - 2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
 - 3. Application and installation instructions.
- C. Samples:
 - 1. Sheet material, 1-1/2 by 12 inches, of each color and pattern with a welded seam using proposed welding rod 12 inches square for each type, pattern and color.
 - 2. Shop Drawings and Certificates: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints. Indicate orientation of directional patterns.
 - 3. Certificates: Quality Control Certificate Submittals and lists specified in paragraph, QUALIFICATIONS.
 - 4. Edge Strips: 6 inches long each type.
 - 5. Adhesive, Underlayment and Primer: Pint container, each type.

1.5 PROJECT CONDITIONS

- A. Maintain temperature of floor materials and room, where work occurs, above 65 °F and below 100 °F for 48 hours before, during and for 48 hours after installation. After above period, room temperature shall not fall below 55 °F.
- B. Construction in or near areas to receive flooring work shall be complete, dry and cured. Do not install resilient flooring over slabs until they have been cured and are sufficiently dry to achieve a bond with adhesive. Follow flooring manufacturer's recommendations for bond and moisture testing.
- C. Building shall be permanently enclosed. Schedule construction so that floor receives no construction traffic when completed.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in original sealed packages or containers; labeled for identification with manufacturer's name and brand.
- B. Deliver sheet flooring full-width roll, completely enclosed in factory wrap, clearly marked with the manufacturer's number, type and color, production run number and manufacture date.
- C. Store materials in weathertight and dry storage facility. Protect from damage due to handling, weather, and construction operations before,

during and after installation. Store sheet flooring on end with ambient temperatures maintained as recommended by manufacturer.

- D. Store sheet flooring on end.
- E. Move sheet vinyl floor coverings and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing Materials (ASTM):
 - E648-10.....Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source
 - E662-12.....Specific Optical Density of Smoke Generated by Solid Materials
 - F710-08.....Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring
 - F1303-04 (2009).....Sheet Vinyl Floor Covering with Backing
 - F1869-10.....Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride
 - F1913-04 (2010).....Sheet Vinyl Flooring without Backing
 - F2170-09.....Determining Relative Humidity in Concrete Floor Slabs using In-situ Probes
- C. Resilient Floor Covering Institute (RFCI):
 - Recommended Work Practices for Removal of Resilient Floor Coverings.

1.8 SCHEDULING

- A. Interior finish work such as plastering, drywall finishing, concrete, terrazzo, ceiling work, and painting work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed. Heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.9 WARRANTY

- A. Submit written warranty, in accordance with FAR Clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to include 2 years.

PART 2 - PRODUCTS

2.1 SHEET VINYL FLOOR COVERINGS

- A. Sheet Vinyl Floor Coverings: Embossed face, minimum thickness nominal

2.3 mm. Sheet flooring shall conform to ASTM F1913 and material requirements specified in ASTM F1303, Type II, Grade 1, backing classification not applicable. Foam-backed sheet flooring is not acceptable.

- B. Size: Provide maximum size sheet vinyl material produced by manufacturer to provide minimum number of joints. Minimum size width acceptable is 72 inches.
- C. Each color and pattern of sheet flooring shall be of same production run.

2.2 WELDING ROD

- A. Product of floor covering manufacturer in color shall match field color of sheet vinyl covering.

2.3 APPLICATION MATERIALS AND ACCESSORIES

- A. Floor and Base Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.
- B. Mastic Underlayment (for Concrete Floors): Provide products with latex or polyvinyl acetate resins in mix. Condition to be corrected shall determine type of underlayment selected for use.

2.4 SHEET FLOORING

- A. ASTM F1303, Type II, Grade 1, except for backing requirements. Foam backed sheet flooring is not acceptable.
- B. Minimum nominal thickness 2.3 mm; 6 feet minimum width.
- C. Critical Radiant Flux: 0.45-watts per sq.cm or more, Class I, per ASTM E648.
- D. Smoke Density: Less than 450 per ASTM E662.
- E. Color and pattern of sheet flooring of the same production run.

2.5 ADHESIVES

- A. Water-resistant type recommended by the sheet flooring manufacturer for the conditions of use. VOC not to exceed 50g/L

2.6 LEVELING COMPOUND (FOR CONCRETE FLOORS)

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.

2.7 PRIMER (FOR CONCRETE SUBFLOORS)

- A. As recommended by the adhesive or sheet flooring manufacturer.

2.8 EDGE STRIPS

- A. As specified in Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

2.9 SEALANT

- A. As specified in Section 07 92 00, JOINT SEALANTS.
- B. Compatible with sheet flooring.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain temperature of sheet flooring above 65 °F for 48 hours before installation.
- B. Maintain temperature of rooms where sheet flooring work occurs above 65 °F for 48 hours, before installation and during installation.
- C. After installation, maintain temperature at or above 65 °F.
- D. Building is permanently enclosed.
- E. Wet construction in or near areas to receive sheet flooring is complete, dry and cured.

3.2 SUBFLOOR PREPARATION

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710.
 - 1. Installer shall examine surfaces on which resilient sheet flooring is to be installed, and shall advise Contractor, in writing, of areas which are unacceptable for installation of flooring material. Installer shall advise Contractor which methods are to be used to correct conditions that will impair proper installation. Installation shall not proceed until unsatisfactory conditions have been corrected.
 - 2. Slab substrates dry, free of curing compounds, sealers, hardeners, and other materials which would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Resilient Floor Covering Institute recommendations in manual RFCI-MRP.
- B. Broom or vacuum clean substrates to be covered by sheet vinyl floor coverings immediately before installation. Following cleaning, examine substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.
- C. Primer: If recommended by flooring manufacturer, prior to application of adhesive, apply concrete slab primer in accordance with manufacturer's directions.
- D. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- E. Fill cracks, joints, depressions, and other irregularities in concrete with leveling compound.
 - 1. Do not use adhesive for filling or leveling purposes.
 - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.

3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- F. Clean floor of oil, paint, dust and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.
- G. Moisture Testing: Perform moisture and pH test as recommended by the flooring and adhesive manufacturers. Perform test locations starting on the deepest part of the concrete structure. Proceed with installation only after concrete substrates meet or exceed the manufacturer's requirements. In the absence of specific guidance from the flooring or adhesive manufacturer, the following requirements are to be met:
 1. Perform moisture vapor emission tests in accordance with ASTM F1869. Proceed with installation only after substrates have a maximum moisture-vapor-emission rate of 3 lbs of water per 1,000 sq. ft. in 24 hours.
 2. Perform concrete internal relative humidity testing using situ probes in accordance with ASTM F2170. Proceed with installation only after concrete reaches maximum 75 percent relative humidity level measurement.
- H. Preparation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives. Coordinate with Asbestos Abatement Section if asbestos abatement procedures will be involved.
- I. Remove existing resilient flooring and adhesive completely in accordance with Resilient Floor Covering Institute recommendations in manual RFCI-WP. Solvents shall not be used.

3.3 INSTALLATION OF FLOORING

- A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.
- B. Maintain uniformity of sheet vinyl floor covering direction and avoid cross seams.
- C. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 6 inches away from parallel joints in flooring substrates.
- D. Match edges of resilient floor coverings for color shading and pattern at seams.
- E. Where resilient sheet flooring abuts other flooring material, floors shall finish level.
- F. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.

- G. Inform the Contracting Officer's Representative (COR) of conflicts between this Section and the manufacturer's instructions or recommendations for auxiliary materials, or installation methods, before proceeding.
- H. Install sheet in full coverage adhesives.
 - 1. Air pockets or loose edges will not be accepted.
 - 2. Trim sheet materials to touch in the length of intersection at pipes and vertical projections; seal joints at pipe with waterproof cement or sealant.
- I. Keep joints to a minimum; avoid small filler pieces or strips.
- J. Follow manufacturer's recommendations for seams at butt joints. Do not leave any open joints that would be readily visible from a standing position.
- K. Follow manufacturer's recommendations regarding pattern match, if applicable.
- L. Installation of Edge Strips:
 - 1. Locate edge strips under center lines of doors unless otherwise indicated.
 - 2. Set resilient strips in adhesive per manufacturer's installation instructions.
- M. Base Installation: As specified in Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

3.4 WELDING

- A. Heat weld all joints of flooring and base using equipment and procedures recommended by flooring manufacturer.
- B. Welding shall consist of routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.
- C. Upon completion of welding, surface across joint shall finish flush, free from voids, and recessed or raised areas.
- D. Fusion of Material: Joint shall be fused a minimum of 65 percent through thickness of material, and after welding shall meet specified characteristics for flooring.

3.5 CLEANING

- A. Clean small adhesive marks during application of sheet flooring and base before adhesive sets, excessive adhesive smearing will not be accepted.
- B. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.
- C. Clean sheet flooring materials per flooring manufacturer's written recommendations.

- D. Vacuum floor thoroughly.
- E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.
- F. Upon completion, COR shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- G. Perform initial maintenance according to flooring manufacturer's written recommendations.

3.6 PROTECTION

- A. Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades, or placement of fixtures and furnishings.
- B. Keep traffic off sheet flooring for 24 hours after installation.
- C. Where construction traffic is anticipated, cover sheet flooring with reinforced kraft paper properly secured and maintained until removal is authorized by the Resident Engineer.
- D. Where protective materials are removed and immediately prior to acceptance, repair any damage, and re-clean sheet flooring.

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SECTION 09 72 16
VINYL-COATED FABRIC WALLCOVERINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies vinyl-coated fabric wallcovering and installation.

1.2 RELATED WORK

- A. Color, Pattern, Type, Direction of Hanging and Areas to Receive Wallcovering: As indicated on the Drawings in the Finish Schedule.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
1. Each type and pattern as specified on the Drawings in the Finish Schedule.
 2. Size: Full width of mill run.
- C. Manufacturer's Certificates:
1. Compliance with CFFA W-101D.
 2. Wallcovering manufacturer's approval of adhesive.
- D. Manufacturer's Literature and Data:
1. Primer and adhesive.
 2. Installation instructions.
 3. Maintenance instructions, including recommended materials and methods for maintaining wallcovering with precautions in use of cleaning material.

1.4 QUALITY ASSURANCE

- A. Finish one complete space with each type (color and pattern) of wallcovering showing specified colors and patterns.
- B. Use approved sample spaces as a standard for work throughout the Project.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver in original unopened containers bearing the manufacturer's name, brand name, and product designation.
- B. Store in accordance with manufacturer's instructions.
- C. Handle to prevent damage to material.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Chemical Fabrics and Film Association, Inc., (CFFA):

2575-96(R2011).....Vinyl Coated Fabric Wallcovering

C. American Society for Testing and Materials (ASTM):

G21-09.....Determining Resistance of Synthetic Polymeric
Materials to Fungi

PART 2 - PRODUCTS

2.1 VINYL-COATED FABRIC WALLCOVERING

- A. Comply with CFFA-2575.
- B. Fungi Resistance: ASTM G21, rating of 0.
- C. Factory-applied clear delustered polyvinyl-fluoride (PVF) coating:
 - 1. Minimum 1/2 mil thickness.
 - 2. Do not include PVF coating weight in minimum total weight.
 - 3. Fire hazard classification with PVF coating: Class A unless specified otherwise.
- D. Type II (Medium Duty).

2.2 ADHESIVE

- A. Use only water-based adhesive having volatile organic compounds not more than 50 g/l.
- B. Vermin and mildew resistant.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Temperatures:
 - 1. Do not perform work until surfaces and materials have been maintained at minimum of 60 degrees F for 3 days before work begins.
 - 2. Maintain minimum temperatures of 60 degrees F until adhesives are dried or cured.
- B. Lighting:
 - 1. Do not proceed unless a minimum lighting level of 15 candlepower per square foot occurs.
 - 2. Measure light level at mid-height of wall.
- C. Ventilation:
 - 1. Provide uniform continuous ventilation in space.
 - 2. Ventilate for a time for not less than complete drying or curing of adhesive.
- D. Protect other surfaces from damage which may be caused by this work.
- E. Remove waste from building daily.

3.2 SURFACE CONDITION

- A. Inspect surfaces to receive wallcoverings to assure that:
 - 1. Patches and repairs are completed.
 - 2. Surface are clean, smooth and prime painted.

- B. Do not proceed until discovered defects have been corrected by other trades and surfaces are ready to receive wallcovering.
- C. Carefully remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings and fastenings, prior to starting work.
- D. Carefully store items for reinstallation.

3.3 APPLICATION OF ADHESIVE

- A. Mix and apply adhesives in accordance with manufacturer's directions.
- B. Prevent adhesive from getting on face of wallcovering.
- C. Apply adhesive to wallcovering back.

3.4 WALLCOVERING INSTALLATION

- A. Use wallcovering of same batch or run in an area. Use fabric rolls in consecutive numerical sequence of manufacture.
- B. Install material completely adhered, smooth, clean, without wrinkles, air pockets, gaps or overlaps.
- C. Extend wallcovering continuous behind non-built-in casework and other items which are close to but not bolted to or touching the walls.
- D. Install wallcovering before installation of resilient base. Extend wallcovering not more than ¼-inch below top of resilient base.
- E. Install panels consecutively in order in which they are cut from the roll including filling spaces above or below windows, doors, or similar penetrations.
- F. Do not install horizontal seams.
- G. Except on match patterns, hang fabric by reversing alternate strips, except as recommended by the manufacturer.
- H. Cutting:
 - 1. Cut on a work table with a straight edge.
 - 2. Joints or seams that are not cut clean are unacceptable.
 - 3. Trim additional selvage to achieve a color and pattern match at seams. Overlapped seams are not allowed.
 - 4. Do not double cut seams on wall unless specified.
 - 5. If double cutting on the wall is necessary, place a 3-inch strip of Type I wallcovering under pasted edge.
 - a. Do not cut into wall surface.
 - b. After cutting, remove strip and excess adhesive from seam before proceeding to next seam.
 - c. Smooth down seam in adhesive for tight bond and joint.
- I. Trim strip-matched patterns, which are not factory pre-trimmed.
- J. Inside Corners:
 - 1. Wrap wallcovering around corner.

2. Do not seam within 2 inches of inside corners.
3. Double cut seam.

K. Outside Corners:

1. Wrap wallcovering around corner.
2. Do not seam within 6 inches of outside corners.
3. Double cut seam.

3.5 PATCHING

- A. Replace surface damaged wallcovering in a space as specified for new work:
 1. Replace full height of surface.
 2. Replace from break in plane to break in plane when same batch or run is not used. Double cut seams.
 3. Adjoining differential colors from separate batches or runs are not acceptable.
- B. Correct loose or raised seams with adhesives to lay flat with tight bonded joint as specified for new work.

3.5 CLEANING AND INSTALLING TEMPORARY REMOVED ITEMS

- A. Remove adhesive from wallcovering as work proceeds.
- B. Remove adhesives where spilled, splashed or splattered on wallcoverings or adjacent surfaces in a manner not to damage surface from which it is removed.
- C. Reinstall previously removed electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings and fastenings.

- - - E N D - - -

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other Sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

1.2 RELATED WORK

- A. Type of Finish, Color, and Gloss Level of Finish Coat: As indicated in the Finish Schedule on the Drawings.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Before work is started or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of Contract award, will be used to determine compliance with the submittal requirements of this Specification. The Contractor may choose to use subsequent MPI "Approved Product List"; however, only one list may be used for the entire Contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample Panels:
 - 1. After painters' materials have been approved and before work is started, submit sample panels showing each type of finish and color specified.
 - 2. Panels to Show Color: Composition board, 4 inches by 10 inches by 1/8-inch.
 - 3. Panel to Show Transparent Finishes: Wood of same species and grain pattern as wood approved for use, 4-inch by 10-inch face by 1/4-inch-thick minimum, and where both flat and edge grain will be exposed, 10 inches long by sufficient size, 2 by 2 inches minimum or actual wood member to show complete finish.
 - 4. Attach Labels to Panel Stating the Following:
 - a. Federal Specification Number or manufacturer's name and product number of paints used.

- b. Product type and color.
- c. Name of Project.
- 5. Strips showing not less than 2-inch-wide strips of undercoats and 4-inch-wide strip of finish coat.
- D. Sample of identity markers if used.
- E. Manufacturers' Certificates indicating compliance with specified requirements:
 - 1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
 - 1. Name of manufacturer.
 - 2. Product type.
 - 3. Batch number.
 - 4. Instructions for use.
 - 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
 - 1. Federal Specification Number, where applicable, and name of material.
 - 2. Surface upon which material is to be applied.
 - 3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 65 and 85 degrees F.

1.5 MOCK-UP PANEL

- A. Before starting application of water paint mixtures, apply paint as specified to an area, not to exceed 100 square feet, selected by Contracting Officer's Representative (COR).
- B. Finish and texture approved by COR will be used as a standard of quality for remainder of work.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):

ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical
Substances and Physical Agents and Biological
Exposure Indices (BEIs)

ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and
Biological Exposure Indices, (Seventh Edition)

C. American National Standards Institute (ANSI):

A13.1-07.....Scheme for the Identification of Piping Systems

D. American Society for Testing and Materials (ASTM):

D260-86.....Boiled Linseed Oil

E. Commercial Item Description (CID):

A-A-1555.....Water Paint, Powder (Cementitious, White and
Colors) (WPC) (cancelled)

A-A-3120.....Paint, For Swimming Pools (RF) (cancelled)

F. Federal Specifications (Fed Spec):

TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For
Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

No. 1-12.....Aluminum Paint (AP)

No. 4-12.....Interior/Exterior Latex Block Filler

No. 5-12.....Exterior Alkyd Wood Primer

No. 7-12.....Exterior Oil Wood Primer

No. 8-12.....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)

No. 9-12.....Exterior Alkyd Enamel MPI Gloss Level 6 (EO)

No. 10-12.....Exterior Latex, Flat (AE)

No. 11-12.....Exterior Latex, Semi-Gloss (AE)

No. 18-12.....Organic Zinc Rich Primer

No. 22-12.....Aluminum Paint, High Heat (up to 590° - 1,100 F)
(HR)

No. 26-12.....Cementitious Galvanized Metal Primer

No. 27-12.....Exterior/Interior Alkyd Floor Enamel, Gloss (FE)

No. 31-12.....Polyurethane, Moisture Cured, Clear Gloss (PV)

No. 36-12.....Knot Sealer

No. 43-12.....Interior Satin Latex, MPI Gloss Level 4

No. 44-12.....Interior Low Sheen Latex, MPI Gloss Level 2

No. 45-12.....Interior Primer Sealer

No. 46-12.....Interior Enamel Undercoat

No. 47-12.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
(AK)

No. 48-12.....Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)

No. 49-12.....Interior Alkyd, Flat, MPI Gloss Level 1 (AK)

- No. 50-12.....Interior Latex Primer Sealer
- No. 51-12.....Interior Alkyd, Eggshell, MPI Gloss Level 3
- No. 52-12.....Interior Latex, MPI Gloss Level 3 (LE)
- No. 53-12.....Interior Latex, Flat, MPI Gloss Level 1 (LE)
- No. 54-12.....Interior Latex, Semi-Gloss, MPI Gloss Level 5
(LE)
- No. 59-12.....Interior/Exterior Alkyd Porch & Floor Enamel,
Low Gloss (FE)
- No. 60-12.....Interior/Exterior Latex Porch & Floor Paint, Low
Gloss
- No. 66-12.....Interior Alkyd Fire Retardant, Clear Top Coat
(ULC Approved) (FC)
- No. 67-12.....Interior Latex Fire Retardant, Top Coat (ULC
Approved) (FR)
- No. 68-12.....Interior/Exterior Latex Porch & Floor Paint,
Gloss
- No. 71-12.....Polyurethane, Moisture Cured, Clear, Flat (PV)
- No. 74-12.....Interior Alkyd Varnish, Semi-Gloss
- No. 77-12.....Epoxy Cold Cured, Gloss (EC)
- No. 79-12.....Marine Alkyd Metal Primer
- No. 90-12.....Interior Wood Stain, Semi-Transparent (WS)
- No. 91-12.....Wood Filler Paste
- No. 94-12.....Exterior Alkyd, Semi-Gloss (EO)
- No. 95-12.....Fast Drying Metal Primer
- No. 98-12.....High Build Epoxy Coating
- No. 101-12.....Epoxy Anti-Corrosive Metal Primer
- No. 108-12.....High Build Epoxy Coating, Low Gloss (EC)
- No. 114-12.....Interior Latex, Gloss (LE) and (LG)
- No. 119-12.....Exterior Latex, High Gloss (acrylic) (AE)
- No. 135-12.....Non-Cementitious Galvanized Primer
- No. 138-12.....Interior High Performance Latex, MPI Gloss Level
2 (LF)
- No. 139-12.....Interior High Performance Latex, MPI Gloss Level
3 (LL)
- No. 140-12.....Interior High Performance Latex, MPI Gloss Level
4
- No. 141-12.....Interior High Performance Latex (SG) MPI Gloss
Level 5

H. Steel Structures Painting Council (SSPC):
SSPC SP 1-04 (R2004)....Solvent Cleaning

SSPC SP 2-04 (R2004)....Hand Tool Cleaning

SSPC SP 3-04 (R2004)....Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Sherwin-Williams: Paint Stores Group, or approved equal.

2.2 MATERIALS

- A. Interior/Exterior Latex Block Filler: MPI 4.
- B. Exterior Latex, Semi-Gloss (AE): MPI 11.
- C. Knot Sealer: MPI 36.
- D. Interior Satin Latex: MPI 43.
- E. Interior Primer Sealer: MPI 45.
- F. Interior Enamel Undercoat: MPI 47.
- G. Interior Alkyd, Semi-Gloss (AK): MPI 47.
- H. Interior Latex Primer Sealer: MPI 50.
- I. Interior Alkyd, Eggshell: MPI 51
- J. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.
- K. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.
- L. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.
- M. Interior Wood Stain, Semi-Transparent (WS): MPI 90.
- N. Wood Filler Paste: MPI 91.

2.3 PAINT PROPERTIES

- A. Use ready-mixed (including colors), except 2-component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.4 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
 - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10 g/l for interior latex paints/primers and 50 g/l for exterior latex paints and primers.
 - 2. Lead-Based Paint:
 - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
 - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation

of residential structures are set forth in Subpart F, Title 24,
Code of Federal Regulations, Department of Housing and Urban
Development.

3. Asbestos: Materials shall not contain asbestos.
4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, cadmium, mercury or mercury compounds or free crystalline silica.
5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
6. Use high-performance acrylic paints in place of alkyd paints, where possible.
7. VOC content for solvent-based paints shall not exceed 250 g/l and shall not be formulated with more than 1 percent aromatic hydrocarbons by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.
- B. Atmospheric and Surface Conditions:
 1. Do not apply coating when air or substrate conditions are:
 - a. Less than 5 degrees F above dew point.
 - b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
 2. Maintain interior temperatures until paint dries hard.
 3. Apply only on clean, dry and frost free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.

3.2 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
 - 1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
 - 2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
 - 3. See other Sections of Specifications for specified surface conditions and prime coat.
 - 4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.
- C. Wood:
 - 1. Sand to a smooth even surface and then dust off.
 - 2. Sand surfaces showing raised grain smooth between each coat.
 - 3. Wipe surface with a tack rag prior to applying finish.
 - 4. Surface painted with an opaque finish:
 - a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
 - b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
 - 5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
 - 6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
 - 7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
 - a. Thin filler in accordance with manufacturer's instructions for application.
 - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

D. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: Where high-temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, for Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
 - a. This includes flat-head countersunk screws used for permanent anchors.
 - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

E. Zinc-Coated (Galvanized) Metal, Aluminum Surfaces Specified Painted:

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot-coat abraded and damaged areas of zinc coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc-Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.

F. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:

1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Remove loose mortar in masonry work.

4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar. Do not fill weep holes. Finish to match adjacent surfaces.
5. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

G. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 1 inch in diameter as specified in Section for plaster or gypsum board.

3.3 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix 2-component and 2-part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in 3 coats; prime, body, and finish. When 2 coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.

- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.
- G. Do not spray paint in existing occupied spaces unless approved by COR, except in spaces sealed from existing occupied spaces.
 - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
 - 2. In areas where paint is applied by spray, mask or enclose with polyethylene or similar air-tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizers and other recessed equipment and similar prefinished items.
- H. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.5 PRIME PAINTING

- A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.
- E. Wood:
 - 1. Use same kind of primer specified for exposed face surface.
 - a. Interior Wood Except for Transparent Finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
 - b. Transparent finishes as specified under Transparent Finishes on Wood except Floors.
- F. Metals Except Boilers, Incinerator Stacks, and Engine Exhaust Pipes:
 - 1. Steel and Iron: MPI 95 (Fast Drying Metal Primer).
 - 2. Zinc-Coated Steel and Iron: MPI 134 (Waterborne Galvanized Primer).
 - 3. Aluminum Scheduled to be Painted: MPI 95 (Fast Drying Metal Primer).
 - 4. Machinery Not Factory Finished: MPI 9 (Exterior Alkyd Enamel (EO)).
 - 5. Asphalt-Coated Metal: MPI 1 (Aluminum Paint (AP)).

G. Gypsum Board:

1. Surfaces scheduled to have MPI 140 (High-Performance Interior Latex, MPI Gloss Level 4).
2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) in shower and bathrooms.
3. Surfaces Scheduled to Receive Vinyl-Coated Fabric Wallcovering:
Use MPI 45 (Interior Primer Sealer).

H. Concrete Masonry Units Except Glazed or Integrally Colored and
Decorative Units: MPI 4 (Block Filler) on interior surfaces.

3.6 EXTERIOR FINISHES

A. Apply following finish coats where indicated in the Finish Schedule on the Drawings.

B. Wood:

1. Do not apply finish coats on surfaces concealed after installation, top and bottom edges of wood doors.
2. Two coats of MPI 11 (Exterior Latex, Semi-Gloss (AE)) on exposed surfaces, except where transparent finish is specified.
3. Two coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat (PV)) for transparent finish.

C. Steel and Ferrous Metal: Two coats of MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) on exposed surfaces, except on surfaces over 200 degrees F.

3.7 INTERIOR FINISHES

A. Apply following finish coats over prime coats in spaces or on surfaces as indicated in the Finish Schedule on the Drawings.

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
 - a. Apply 2 coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.
 - b. Two coats of MPI 51 (Interior Alkyd, Eggshell (AK)).
 - c. Ferrous Metal over 200 degrees F: Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One coat MPI 22 (High-Heat-Resistant Coating (HR)).

C. Gypsum Board: One coat of MPI 45 (Interior Primer Sealer) plus 2 coats of MPI 140 (Interior High-Performance Latex, MPI Gloss Level 4).

D. Plaster: One coat of MPI 50 (Interior Latex Primer Sealer) plus 2 coats of MPI 140 (Interior High-Performance Latex, MPI Gloss Level 4).

E. Masonry and Concrete Walls:

1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
2. Two coats of MPI 140 (Interior High-Performance Latex MPI Gloss level 4).

F. Wood:

1. Sanding:
 - a. Use 220-grit sandpaper.
 - b. Sand sealers and varnish between coats.
 - c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.
2. Sealers:
 - a. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
 - b. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
 - c. Sand as specified.
3. Paint Finish: One coat of MPI 45 (Interior Primer Sealer) plus 2 coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) (SG).
4. Transparent Finishes on Wood Except Floors:
 - a. Stain Finish:
 - 1) One coat of MPI 90 (Interior Wood Stain, Semi-Transparent (WS)).
 - 2) Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.
 - 3) One coat of sealer as written in 2.1 E.
 - 4) Two coats of MPI 31 (Polyurethane Moisture Cured, Clear Gloss (PV)).

3.8 REFINISHING EXISTING PAINTED SURFACES

- A. Clean, patch and repair existing surfaces as specified under surface preparation.
- B. Remove and reinstall items as specified under surface preparation.
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.

- E. Except where scheduled for complete painting, apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one coat of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss).
- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.9 PAINT COLOR

- A. Color and gloss of finish coats is indicated in the Finish Schedule on the Drawings.
- B. For additional requirements regarding color, see Articles REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
- C. Coat Colors:
 - 1. Color of Priming Coat: Lighter than body coat.
 - 2. Color of Body Coat: Lighter than finish coat.
 - 3. Color prime and body coats shall not show through the finish coat and shall mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework: Paint to match color of wall.

3.10 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

- A. Field painting of mechanical and electrical consists of cleaning; touching up abraded shop prime coats; and applying prime, body, and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted, paint as specified under paragraph H, Colors.
- C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY.
- D. Paint after tests have been completed.

- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
- G. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.
- H. Color: Paint items having no color specified in Finish Schedule on the Drawings to match surrounding surfaces.
- I. Apply paint systems on properly prepared and primed surface as follows:
 - 1. Exterior Locations:
 - a. Apply 2 coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) to the following ferrous metal items: Vent and exhaust pipes with temperatures under 200 degrees F, roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
 - b. Apply 2 coats of MPI 11 (Exterior Latex, Semi Gloss (AE)) to the following metal items: Galvanized and zinc-copper alloy metal.
 - 2. Interior Locations:
 - a. Apply 2 coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
 - 1) Metal under 200 degrees F of items such as bare piping, fittings, hangers and supports.
 - 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
 - 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
 - b. Paint electrical conduits containing cables rated 600 volts or more using 2 coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.
 - 3. Other Exposed Locations: Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One coat of MPI 50 (Interior Latex Primer Sealer) and 1 coat of MPI 11 (Exterior Latex Semi-Gloss (AE)).

3.11 BUILDING AND STRUCTURAL WORK FIELD PAINTING

- A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11,B.

1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Finish Schedule on the Drawings.
 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
 3. Identity painting and safety painting.
- B. Building and Structural Work Not Painted:
1. Prefinished Items:
 - a. Casework, doors, metal panels, wallcovering, and similar items specified factory finished under other sections.
 - b. Factory finished equipment.
 2. Finished Surfaces:
 - a. Hardware except ferrous metal.
 - b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
 - c. Signs, fixtures, and other similar items integrally finished.
 3. Concealed Surfaces:
 - a. Inside shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
 - b. Inside walls or other spaces behind access doors or panels.
 - c. Surfaces concealed behind permanently installed casework and equipment.
 4. Moving and Operating Parts:
 - a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
 - b. Tracks for overhead or coiling doors, shutters, and grilles.
 5. Labels:
 - a. Code required label, such as Underwriters Laboratories Inc., Inchcape Testing Services, Inc., or Factory Mutual Research Corporation.
 - b. Identification plates, instruction plates, performance rating, and nomenclature.
 6. Ceilings, walls, columns in interstitial spaces.

3.12 IDENTITY PAINTING SCHEDULE

- A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.

1. Legend may be identified using 2.1,G. options or by stencil applications.
2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 40 feet apart on straight runs of piping. Identification next to plumbing fixtures is not required.
3. Locate legends clearly visible from operating position.
4. Use arrow to indicate direction of flow.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on Drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
 - a. High Pressure - 60 psig and above.
 - b. Medium Pressure - 15 to 59 psig.
 - c. Low Pressure - 14 psig and below.
 - d. Add fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Shop Compressed Air		Yellow	Black	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High-Pressure Steam		Yellow	Black	H.P. _____*
High-Pressure Condensate Return		Yellow	Black	H.P. Ret _____*
Medium-Pressure Steam		Yellow	Black	M.P. Stm _____*
Medium-Pressure Condensate Return		Yellow	Black	M.P. Ret _____*
Low-Pressure Steam		Yellow	Black	L.P. Stm _____*
Low-Pressure Condensate Return		Yellow	Black	L.P. Ret _____*
High-Temperature Water Supply		Yellow	Black	H. Temp Wtr Sup
High-Temperature Water Return		Yellow	Black	H. Temp Wtr Ret
Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup

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Hot Water Heating Return		Yellow	Black	H. W. Htg Ret
Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade		Brown	White	Fuel Oil-Grade __*
(Diesel Fuel included under Fuel Oil)				
Boiler Water Sampling		Yellow	Black	Sample
Chemical Feed		Yellow	Black	Chem Feed
Continuous Blow-Down		Yellow	Black	Cont. B D
Pumped Condensate		Black		Pump Cond
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent
Alkali		Yellow	Black	Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Yellow	Black	Acid Waste
Vent		Yellow	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				

Sprinkler	Red	White	Auto Spr
Standpipe	Red	White	Stand
Sprinkler	Red	White	Drain

Hot Water Supply Domestic/Solar Water	H.W. Sup Dom/SW
Hot Water Return Domestic/Solar Water	H.W. Ret Dom/SW

7. Electrical conduits containing feeders over 600 volts, paint legends using 2-inch-high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 20-foot intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class.

B. Fire and Smoke Partitions:

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 2-1/2 inches high.
2. Stenciled Message: "SMOKE BARRIER" or "FIRE BARRIER" as applicable.
3. Locate not more than 20 feet on center on corridor sides of partitions, and with a least one message per room on room side of partition.
4. Use semigloss paint of color that contrasts with color of substrate.

3.13 PROTECTION, CLEANUP, AND TOUCHUP

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

SECTION 10 11 13
MARKER BOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies marker boards and related items. Refer to Drawings for additional information and requirements regarding the marker boards and accessories.
- B. Boards may be either factory or field assembled.
- C. Where shown, assemble marker boards with tackboards into a single unit.

1.2 RELATED WORK

- A. Color of aluminum anodic coating and marker board writing surface: As shown in Finish Schedule on the Drawings.

1.3 QUALITY ASSURANCE

- A. Boards shall be the products of one manufacturer.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Shop Drawings: Identifying all parts by name and material and showing design, construction, installation, anchorage and relation to adjacent construction.
- C. Manufacturer's Literature and Data: Marker boards.
- D. Samples:
 - 1. Marker board writing surface, 6 by 6 inches, each color, mounted on backing.
 - 2. Integrally colored anodized aluminum, 6-inch length.
 - 3. Each accessory (after approval, may be used in the work).

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards (ANSI):
 - Z97.1-09.....Safety Glazing Materials Used in Buildings -
Safety Performance Specifications and Methods of
Test
- C. American Society for Testing and Materials (ASTM):
 - B221/B221M-08.....Aluminum and Aluminum Alloy Extruded Bars, Rods,
Wire, Shapes and Tubes
 - C1036-06.....Flat Glass

C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated
and Uncoated Glass

F104-03 (R2009).....Nonmetallic Gasket Materials

D. Composite Panel Association (CPA):

A208.1-09.....Particleboard

A135.4-04.....Basic Hardboard

E. Porcelain Enamel Institute (PEI)

1001-11.....Architectural Porcelain Enamel

PART 2 - PRODUCTS

2.1 MARKER BOARD

- A. Marker boards shall consist of a writing surface, snap on aluminum frame, marker trough, mullions, display rail and accessories, grounds and other items specified and shown.

2.2 FABRICATION

A. Materials:

1. Aluminum, Extruded: ASTM B221.
2. Backing: Hardboard, AHBA A135.4 or particleboard, CPA A208.1.

B. Components:

1. Writing Surface: Factory assembly consisting of face sheet of 24-gage sheet steel with porcelain enamel board texture finish conforming to PEI 1001, laminated to a hardboard or particleboard backing, 3/8- to 1/2-inch) thick, and a 0.005-inch-thick aluminum foil back sheet laminated to back-face.
2. Frames (Trim): Extruded aluminum, 0.060-inch thick, snap-on type, approximate face width 1-3/4 inches, depth and configuration as required to return to wall and engage clips.
3. Trough: Extruded aluminum, 0.092-inch thick, not less than 3-inch projection from writing surface with grooved top surface, closed ends and return to wall surface at underside. Design to be snap-on type with concealed fasteners.
4. Accessories: Fabricate from aluminum with holders from spring steel. Design to suit display rail. Furnish accessories as follows:

<u>Accessory Type</u>	<u>Lineal feet of rail per accessory</u>
Paper holder	Full length of marker board
Map hook	Full length of marker board

5. Mullions: Snap-on type, same material and face width as frames, designed to finish flush with frame.

- 6. Grounds: Continuous zinc-coated (galvanized) steel or extruded aluminum members designed to support the board writing surface and clips for snap-on frames, map rail and chalk tray.
- 7. Clips: Manufacturer's standard as required to support frame, mullions, display rail, and trough.
- C. Boards 12 feet or less in length shall be in one piece. Larger units shall have one joint at center. Joints shall have metal spline, with faces in same plane and edges shall touch along entire length.
- D. Finish exposed aluminum surfaces as follows: AA 45 chemically etched medium matte, with clear anodic coating Class II Architectural, 0.4 mils thick (AA-M12C22A32).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install units in accordance with the manufacturer's installation instructions, use concealed fasteners.
- B. Inspect surfaces and related construction to receive units. Partitions shall have reinforcing to receive fasteners. Verify type and placement of reinforcement.
- C. Do not proceed with the installation until reinforcement is in place and surfaces are flat.
- D. Assemble units as specified by the manufacturer.

3.2 INSTALLATION OF MARKER BOARD

- A. Mount board with adhesive and blocking pads spaced 16 inches on center each way.
- B. Grounds designed to receive clips for snap-on trim shall be continuous and be secured 12 inches on center. Space clips 12 inches on center.
- C. Miter trim at corners, conceal fasteners. Modify trim as required to conform to surrounding construction details.

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SECTION 10 11 23
TACKBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies tackboards (bulletin boards) and glass door bulletin boards and related items. Refer to Drawings for additional information and requirements regarding the tackboards, bulletin boards and accessories.
- B. Boards may be either factory or field assembled.
- C. Where shown, assemble both marker boards and tackboards into a single unit.

1.2 RELATED WORK

- A. Color of Aluminum Anodic Coating Tackboard: As indicated in Finish Schedule on the Drawings.

1.3 QUALITY ASSURANCE

- A. Boards shall be the products of one manufacturer.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Shop Drawings: Identifying all parts by name and material and showing design, construction, installation, anchorage and relation to adjacent construction.
- C. Manufacturer's Literature and Data:
 - 1. Bulletin board.
 - 2. Glass door bulletin board.
- D. Samples:
 - 1. Tackboard, 6 by 6 inches, each color, mounted on backing.
 - 2. Cork filled map rail, 6-inch length.
 - 3. Each accessory (after approval, may be used in the work).

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series.....Metal Finishes Manual
 - AMP 501.....Finishes for Aluminum
- C. American National Standards Institute(ANSI):

Z97.1-09.....Safety Glazing Materials Used in Buildings -
Safety Performance Specifications and Methods of
Test

D. American Society for Testing and Materials (ASTM):

B221/B221M-08.....Aluminum and Aluminum Alloy Extruded Bars, Rods,
Wire, Shapes and Tubes

C1036-06.....Flat Glass

C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated
and Uncoated Glass

F104-03 (R2009).....Nonmetallic Gasket Materials

E. Composite Panel Association (CPA):

A208.1-09.....Particleboard

A135.4-04.....Basic Hardboard

PART 2 - PRODUCTS

2.1 BULLETIN BOARD

A. Bulletin board shall consist of a tackboard, snap-on aluminum frame,
grounds and other items specified and shown.

2.2 GLASS DOOR BULLETIN BOARD

A. Glass door bulletin board shall consist of a tackboard, aluminum tubular
frame, sliding aluminum framed glazed doors and other items specified
and shown.

2.3 FABRICATION

A. Materials:

1. Aluminum, Extruded: ASTM B221.
2. Cork: ASTM F104, Type II, mildew resistant, Class 2.
3. Glass: ASTM C1036, Clear, Class 1, Quality q3, 1/4-inch thick.
4. Tempered Glass: ASTM C1048, Clear Kind FT, Condition A, Type I,
Class 1, Quality q3, 1/4-inch thick. Safety glass, ANSI Z97.1,
labeled.
5. Backing: Hardboard, AHBA A135.4 or particleboard, CPA A208.1.

B. Components:

1. Tackboard: Cork face, 1/4-inch thick, factory laminated to a
hardboard or particleboard backing of thickness required so that the
face of the cork will be in the same plane as the face of the marker
board writing surface, 1/4- to 3/8-inch thick.
2. Frames (Trim): Extruded aluminum, 0.060-inch thick, snap-on type,
approximate face width 1-3/4 inches, depth and configuration as
required to return to wall and engage clips.

3. Display Rail: Snap-on type, same materials as frames, approximate face width 1 inch with 1/4-inch-thick cork insert.
 4. Mullions: Snap-on type, same material and face width as frames, designed to finish flush with frame.
 5. Grounds: Continuous zinc-coated (galvanized) steel or extruded aluminum members designed to support the tackboard and clips for snap-on frames, and map rail
 6. Clips: Manufacturer's standard as required to support frame, mullions, and display rail,
 7. Tubular Frame (For Glass Door Bulletin Board): Extruded aluminum, 0.092-inch thick; tubular or open back in section, with flanges for concealed attachment, designed to support door hardware and tackboard.
- C. Bulletin boards 12 feet or less in length shall be in 1 piece. Larger units shall have 1 joint at center. Joints shall have metal spline, with faces in same plane and edges shall touch along entire length.
- D. Finish Exposed Aluminum Surfaces as Follows: AA 45 chemically etched medium matte, with clear anodic coating Class II Architectural, 0.4 mils thick (AA-M12C22A32).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install units in accordance with the manufacturer's installation instructions, use concealed fasteners.
- B. Inspect surfaces and related construction to receive units. Partitions shall have reinforcing to receive fasteners. Verify type and placement of reinforcement.
- C. Do not proceed with the installation until reinforcement is in place and surfaces are flat.
- D. Assemble units as specified by the manufacturer.

3.2 INSTALLATION OF BULLETIN BOARD (EXCEPT GLASS DOOR BULLETIN BOARDS)

- A. Mount bulletin boards with adhesive and blocking pads spaced 16 inches on center each way.
- B. Grounds designed to receive clips for snap-on trim shall be continuous and be secured 12 inches on center. Space clips 12 inches on center.
- C. Miter trim at corners, conceal fasteners. Modify trim as required to conform to surrounding construction details.

3.3 INSTALLATION OF GLASS DOOR BULLETIN BOARDS

- A. Glass door bulletin board units shall be factory assembled, except tackboard may be either field mounted or shop mounted on frame.

Department of Veterans Affairs, Renovation of Dermatology Clinic
for Primary Care at
Michael E. DeBakey VA Medical Center, Houston, Texas
Project Number 580-13-405 Construction Documents Submission

B. Mounting bolts or screws shall be oval head of stainless steel or
chromium-plated steel or brass. Space fasteners 20 inches on center,
except not less than 3 fasteners each side, top and bottom. Heads of
fasteners shall not show on the frame face.

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SECTION 10 21 23
CUBICLE CURTAIN TRACKS

PART 1 - GENERAL

1.1 DESCRIPTION

This Section specifies cubicle curtain track (CCT) and intravenous support assembly (IV).

1.2 RELATED WORK

Steel shapes for suspending track assembly: Section 05 50 00, METAL FABRICATIONS and Section 09 51 00, ACOUSTICAL CEILINGS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. One 12-inch-long piece of cubicle curtain track with carrier access and end stop.
 - 2. One clip anchor for fastening track to grid system of acoustical ceilings.
 - 3. One curtain carrier.
 - 4. One intravenous support assembly consisting 12-inch-long pieces of track, carrier assembly, and bottle pendant.
- C. Shop Drawings: Showing layout of tracks and method of anchorage.
- D. Manufacturer's Literature and Data:
 - 1. Cubicle curtain track.
 - 2. Intravenous support assembly.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver material in original package marked to identify the contents, brand name, and the name of the manufacturer or supplier.
- B. Store in dry and protected location. Store so as to not bend or warp the tracks.
- C. Do not open packages until contents are needed for installation, unless verification inspection is required.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B456-03(R2009).....Electrodeposited Coatings for Copper Plus Nickel
Plus Chromium and Nickel Plus Chromium

C. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual

PART 2 - PRODUCTS

2.1 CUBICLE CURTAIN TRACKS

- A. Surface-Mounted Suspended Type:
 - 1. Channel Tracks (Surface-Mounted Type): Extruded aluminum, ASTM B221, alloy 6063, temper T5 or T6, channel shaped, with smooth inside raceway for curtain carriers.
 - 2. Tubular Track (Suspended Type): Seamless drawn aluminum tubing, ASTM B221, Alloy 6061 Temper T6, 1-inch outside diameter, not less than 0.060-inch wall thickness, slotted for interior carriers.
- B. Curtain Carriers: Nylon or delrin carriers, with either nylon or delrin wheels on metal, delrin, or nylon axles. Equip each carrier with either stainless-steel, chromium-plated brass or steel hooks with swivel, or nickel chromium-plated brass or stainless-steel bead chain and hook assembly, or delrin carriers may have moulded on delrin hooks. Hook for bead chain may be the same material and finish as the bead chain or may be chromium-plated steel. Provide 2.2 carriers for every 1 foot of each section of each track length, plus one additional carrier.
- C. End Stop Connectors, Ceiling Flanges and Other Accessories: Fabricate from the same material with the same finish as the tracks or from nylon.
- D. Hangers and Fittings: Fabricate from the same material with the same finish as the tracks. Hangers may be round or square for channel tracks and round for tubular tracks. Design fittings to be compatible with design of tracks and to safely transmit the track load to the hangers.
- E. At end of each section of track, make provision for insertion and removal of carriers. Design to prevent accidental removal of carrier. Any operating mechanism shall be removable with common tools.

2.2 INTRAVENOUS SUPPORT ASSEMBLY

- A. Assembly includes track, carrier assembly, bottle holding pendant, curved track sections and curved connectors, and all components and accessories required for a working installation.
- B. Track: Surface-mounted channel or "I" beam shaped, extruded aluminum. Equip track with removable section at splicing clamp for carrier removal. Overall size of track shall be as shown on Drawings.
- C. Carrier Assembly: Assembly shall include a body made of either stainless steel or aluminum, and be equipped with 4 ball bearing nylon wheels and

lockstop to insure insulation of carrier from track. Equip carrier with a positive locking device to hold carrier stationary when in use. Provide with either a stainless-steel or chromium-plated brass hook for support of bottle-holding pendent.

- D. Bottle-Holding Pendent: Equip with a minimum of 3, stainless-steel, chromium-plated steel, or chromium-plated brass arms connected to adjustable shaft of same material. Adjustable shaft shall permit bottle-holding hub to adjust from full height to approximately 6 feet 3 inches above finished floor. Provide shaft with a built-in locking device for vertical height adjustments. Locking device shall be activated by push button or similar easily operated one-hand control.

2.3 FASTENERS

- A. Exposed Fasteners, Screws and Bolts: Stainless-steel or chromium/nickel plated brass.
- B. Concealed Fasteners, Screws and Bolts: Hot-dip galvanized (except in high-moisture areas use stainless steel).
- C. Metal Clips: Anchor curtain tracks to exposed grid of lay-in acoustical tile ceilings, with concealed metal (butterfly) type or two-piece snap-locking-type ceiling clip of high-strength spring steel. When it is not possible to install the metal ceiling clip, the cubicle curtain track may be screwed to the ceiling grid. Screws within the track for attachment to ceiling shall have countersunk heads or low-profile flat heads to allow free movement of curtain carriers.

2.4 FINISHES

- A. Aluminum: Finish numbers for aluminum specified are in accordance with The Aluminum Association's Designation System. AA-C22A31 finish chemically etched medium matte, with clear anodic coating, Class II Architectural, 0.4 mils thick.
- B. Chrome/Nickel Plating: Satin or polished finish as specified, ASTM B546, minimum thickness of chromium plate as follows:
1. 0.2 mil on copper alloys.
 2. 0.4 mil on steel.
- C. Stainless Steel: No. 4 in accordance with NAAMM Metal Finishes Manual.

2.5 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form tracks and bends of lengths that will produce the minimum number of joints. Make track sections up to 16 feet without joints. Form corner bend on a 12-inch radius.

- C. Provide steel anchor plates, supports, and anchors for securing components to building construction.
- D. Form flat surface without distortion.
- E. Shop assemble components and package complete with anchors and fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install tracks after finish painting and ceiling finishing operations are complete.
- B. Install track level and hangers plumb and securely anchor to the ceiling or suspend from above to form a rigid installation.
- C. Anchor surface-mounted curtain tracks directly to exposed grid of lay-in acoustical tile ceilings with suitable fasteners, spaced approximately 24 inches on center.
- D. Anchor surface-mounted curtain tracks to concrete, plaster and gypsum board ceilings with a minimum of 1/8-inch-diameter fastenings or concealed clips spaced not more than 3 feet on center.
- E. Install suspended track 7 feet 3 inches above the finished floor, with hangers spaced no more than 4 feet on center. At ceiling line, provide flange fittings secured to hangers with set screws. Secure track to walls with flanged fittings and to hangers with special fittings.
- F. Securely fasten end stop caps to prevent their being forced out by the striking weight of carriers.
- G. Anchor surface-mounted intravenous track directly to support system above ceiling as shown.
- H. Remove damaged or defective components and replace with new components or repair to the original condition.

3.2 ACCEPTANCE

- A. Track shall be installed neat, rigid, plumb, level and true, and securely anchored to the overhead construction.
- B. Carrier units shall operate smoothly and easily over the full range of travel.

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SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies wall guards (crash rails or bumper guards), handrails, chair rails, corner guards and high-impact wallcovering.

1.2 RELATED WORK

- A. Armor Plates and Kick Plates Not Specified in This Section: Section 08 71 00, DOOR HARDWARE.
- B. Color and Texture of Aluminum and Resilient Material: As indicated in the Finish Schedule on the Drawings.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design and installation details.
- C. Manufacturer's Literature and Data:
1. Handrails.
 2. Chair rails.
 3. Wall guards (crash rails).
 4. Corner guards.
 5. High-impact wallcovering.
- D. Test Report: Showing that resilient material complies with specified fire and safety code requirements.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 70 degrees F for at least 48 hours prior to installation.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
- A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet, and Strip

B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods,
Wire, Shapes, and Tubes

D256-06.....Impact Resistance of Plastics

D635-06.....Rate of Burning and/or Extent and Time of
Burning of Self-Supporting Plastics in a
Horizontal Position

E84-09.....Surface Burning Characteristics of Building
Materials

C. The National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06.....Metal Finishes Manual

D. National Fire Protection Association (NFPA):

80-10.....Standard for Fire Doors and Windows

E. Society of American Automotive Engineers (SAE):

J 1545-05.....Instrumental Color Difference Measurement for
Exterior Finishes

F. Underwriters Laboratories Inc. (UL):

Annual Issue.....Building Materials Directory

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A167, Type 302B.

B. Aluminum Extruded: ASTM B221, Alloy 6063, Temper T5 or T6. Aluminum alloy used for colored anodizing coating shall be as required to produce specified color.

C. Resilient Material:

1. Extruded and injection-molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:

a. Minimum impact resistance of 25 ft. lbs. per sq. ft. when tested in accordance with ASTM D256 (Izod impact, ft. lbs. per inch notch).

b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.

c. Rated self extinguishing when tested in accordance with ASTM D635.

d. Material shall be labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.

e. Integral color with all colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.

f. Same finish on exposed surfaces.

2.2 CORNER GUARDS

- A. Resilient, Shock-Absorbing Corner Guards: Surface mounted as shown on Drawings, formed to profile shown.
1. Snap-on corner guard formed from resilient material, minimum 0.078-inch thick, free floating on a continuous 0.063-inch-thick extruded aluminum retainer. Provide appropriate mounting hardware, cushions and base plates as required.
 2. Provide factory-fabricated end closure caps at top and bottom of surface mounted corner guards.

2.3 CHAIR RAILS, WALL GUARDS AND HANDRAILS

- A. Resilient Chair Rails, Wall Guards and Handrails:
1. Handrails: Snap-on covers of resilient material, minimum 0.078-inch thick, shall be free-floated on a continuous, extruded aluminum retainer, minimum 0.072-inch thick, anchored to wall at maximum 30 inches on center. For profile, size and locations, see Drawings.
 2. Chair Rails and Wall Guards (Crash Rails): Snap-on covers of resilient material, minimum 0.110-inch thick, shall be free-floated over 2-inch-wide aluminum retainer clips, minimum 0.090-inch thick, anchored to wall at maximum 24 inches on center, supporting a continuous aluminum retainer, minimum 0.062-inch thick; or, shall be free-floated over a continuous extruded aluminum retainer, minimum 0.090-inch thick anchored to wall at maximum 24 inches on center. For profiles, sizes and locations, see Drawings.
 3. Provide handrails, chair rails and wall guards (crash rails) with prefabricated and closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners shall be field adjustable to assure close alignment with handrails, chair rails and wall guards (crash rails). Screw or bolt closure caps to aluminum retainer.

2.4 HIGH-IMPACT WALLCOVERING

- A. Fabricate from vinyl acrylic or polyvinyl chloride resilient material minimum 0.06-inch thick, designed especially for interior use.
- B. Coordinate with guard rail protection material and supplier for proper fit, installation and color.
- C. Provide adhesive as recommended by the wallcovering manufacturer.

2.5 FASTENERS AND ANCHORS

- A. Provide fasteners and anchors as required for each specific type of installation.

- B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.

2.6 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Aluminum:
 - 1. Exposed Aluminum: AAC22A31 chemically etched medium matte, with clear anodic coating, Class II Architectural, 0.4 mil thick.
 - 2. Concealed Aluminum: Mill finish as fabricated, uniform in color and free from surface blemishes.
- C. Resilient Material: Embossed texture and color in accordance with SAE J 1545 and as indicated in the Finish Schedule on the Drawings.

PART 3 - INSTALLATION

3.1 RESILIENT CORNER GUARDS

- A. Install corner guards on walls in accordance with manufacturer's instructions.

3.2 RESILIENT HANDRAILS, RESILIENT CHAIR RAILS AND RESILIENT WALL GUARDS (CRASH RAIL)

- A. Secure guards to walls with mounting cushions, brackets, and fasteners in accordance with manufacturer's details and instructions.
- B. Install handrails, chair rails, and wall guards at elevations in compliance with ADA/ABA, at existing hospital height, if existing height is in compliance with applicable codes and regulations.

3.3 HIGH-IMPACT WALLCOVERING

- A. Surfaces to receive protection shall be clean, smooth and free of obstructions.
- B. Apply with adhesive in controlled environment according to manufacturer's recommendations.

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SECTION 10 28 00
TOILET AND SHOWER ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies manufactured items usually used in dressing rooms, toilets, baths, locker rooms and at sinks in related spaces.
- B. Items Specified:
 - 1. Paper towel dispenser.
 - 2. Combination paper towel dispenser and disposal unit.
 - 3. Waste receptacles.
 - 4. Toilet tissue dispenser.
 - 5. Grab bars.
 - 6. Shower curtain rods.
 - 7. Clothes hooks, robe or coat.
 - 8. Towel bars.
 - 9. Metal-framed mirror.
 - 10. Medicine cabinet.
 - 11. Foot-operated soap dispenser.
 - 12. Soap dishes.
 - 13. Paper cup dispenser.
 - 14. Mop racks.
 - 15. Stainless-steel shelves, Type 44, Type 45, or Type 45C, as shown on Drawings.
 - 16. Stainless-steel shelves at wheelchair lavatory.
 - 17. Diaper changing station.
- C. This Section also specifies custom-fabricated items used in toilets and related spaces.

1.2 RELATED WORK

- A. Color of Finishes: As indicated in the Finish Schedule on the Drawings.
- B. Color of Vinyl Fabric: As indicated in the Finish Schedule on the Drawings.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Each product specified.
 - 2. Paper towel dispenser and combination dispenser and disposal units.

3. Metal-framed mirrors, showing shelf where required, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.
4. Shower curtain rods, showing required length for each location.
5. Grab bars, showing design and each different type of anchorage.
6. Medicine cabinets showing design and installation.
7. Foot-operated soap dispenser, showing anchorage and components.
8. Show material and finish, size of members, and details of construction, installation and anchorage of mop racks.

C. Samples:

1. One of each type of accessory specified.
2. After approval, samples may be used in the work.

D. Manufacturer's Literature and Data:

1. All accessories specified.
2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
3. Show working operations of spindle for toilet tissue dispensers.
4. Mop racks.

E. Manufacturer's Certificates:

1. Attesting that soap dispensers are fabricated of material that will not be affected by liquid soap or aseptic detergents, Phisoex and solutions containing hexachlorophene.
2. Anodized finish as specified.

1.4 QUALITY ASSURANCE

- A. Each product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be assembled to the greatest extent possible before delivery to the site.
- D. Include additional features which are not specifically prohibited by this Specification, but which are a part of the manufacturer's standard commercial product.

1.5 PACKAGING AND DELIVERY

- A. Pack accessories individually to protect finish.
- B. Deliver accessories to the Project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.

- D. Deliver products to site in sealed packages of containers; labeled for identification with manufacturer's name, brand, and contents.

1.6 STORAGE

- A. Store products in weathertight and dry storage facility.
- B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
- A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet and Strip
- A176-99(R2009).....Stainless and Heat-Resisting Chromium Steel
Plate, Sheet, and Strip
- A269-10.....Seamless and Welded Austenitic Stainless-Steel
Tubing for General Service
- A312/A312M-09.....Seamless and Welded Austenitic Stainless-Steel
Pipes
- A653/A653M-10.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-
Iron Alloy-Coated (Galvannealed) by the Hot-Dip
Process
- B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods,
Wire, Shapes, and Tubes
- B456-03(R2009).....Electrodeposited Coatings of Copper Plus Nickel
Plus Chromium and Nickel Plus Chromium
- C1036-06.....Flat Glass
- C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated
and Uncoated Glass
- D635-10.....Rate of Burning and/or Extent and Time of
Burning of Self Supporting Plastics in a
Horizontal Position
- F446-85(R2009).....Consumer Safety Specification for Grab Bars and
Accessories Installed in the Bathing Area
- D3453-07.....Flexible Cellular Materials - Urethane for
Furniture and Automotive Cushioning, Bedding,
and Similar Applications
- D3690-02(R2009).....Vinyl-Coated and Urethane-Coated Upholstery
Fabrics

- C. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual
- D. American Welding Society (AWS):
D10.4-86 (R2000).....Welding Austenitic Chromium-Nickel Stainless-
Steel Piping and Tubing
- E. Federal Specifications (Fed. Specs.):
A-A-3002.....Mirrors, Glass
FF-S-107C (2).....Screw, Tapping and Drive
FF-S-107C.....Screw, Tapping and Drive
WW-P-541E(1).....Plumbing Fixtures (Accessories, Land Use) Detail
Specification

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: ASTM B221, Alloy 6063-T5 and Alloy 6463-T5.
- B. Stainless Steel:
 - 1. Plate or Sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
 - 2. Tube: ASTM A269, Alloy Type 302, 304, or 304L.
- C. Stainless-Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.
- D. Stainless-Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.
- E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.
- F. Glass:
 - 1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors, and for mirror doors in medicine cabinets.
 - 2. ASTM C1036, Type 1 Class 1 Quality q3, for shelves in medicine cabinets.
- G. Foam Rubber: ASTM D3453, Grade BD, Type 2.
- H. Vinyl Covering: ASTM D3690, Vinyl-coated fabric, Class A.
- I. Plywood: PS1, Grade CD.

2.2 FASTENERS

- A. Exposed Fasteners: Stainless steel or chromium-plated brass, finish to match adjacent surface.
- B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture areas such as showers or bath tubs use stainless steel).
- C. Toggle Bolts: For use in hollow masonry or frame construction.
- D. Hex Bolts: For through-bolting on thin panels.

- E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.
- F. Screws:
 - 1. ASME B18.6.4.
 - 2. Fed Spec. FF-S-107, Stainless steel Type A.
- G. Adhesive: As recommended by manufacturer for products to be joined.

2.3 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum: AA-C22A41, Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
- C. AA-M32: Mechanical finish, medium satin.
 - 1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
 - 2. Stainless Steel: NAAMM AMP 503, Finish 4.
 - 3. Ferrous Metal:
 - a. Shop Prime: Clean, pretreat, and apply 1 coat of primer and bake.
 - b. Finish: Over primer, apply 2 coats of alkyd or phenolic resin enamel, and bake.
 - 4. Nylon-Coated Steel: Nylon coating powder formulated for a fluidized bonding process to steel to provide a hard smooth, medium gloss finish, not less than 0.012-inch thick, rated as self-extinguishing when tested in accordance with ASTM D635.

2.4 FABRICATION - GENERAL

- A. Welding, AWS D10.4.
- B. Grind, dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.
- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.
- G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
- H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- I. Key items alike.
- J. Provide templates and rough-in measurements as required.
- K. Round and deburr edges of sheets to remove sharp edges.

2.5 PAPER TOWEL DISPENSERS

- A. Surface-mounted type with sloping top.
- B. Dispensing capacity for 300 sheets of any type of paper toweling.
- C. Fabricate of stainless steel.
- D. Provide door with continuous hinge at bottom, and either spring tension cam lock or tumbler lock, keyed alike, at top and a refill sight slot in front.

2.6 COMBINATION PAPER TOWEL DISPENSER AND DISPOSAL UNITS

- A. Recessed type.
- B. Dispensing capacity for 400 sheets of any type of paper toweling.
- C. Fabricate of stainless steel.
- D. Form face frames, from one piece.
- E. Provide each door with continuous stainless-steel piano hinge and tumbler lock, keyed alike.
- F. Provide removable waste receptacle approximately 10.5-gallon capacity, fabricated of 0.018-inch-thick stainless steel.

2.7 WASTE RECEPTACLES

- A. Semi-recessed type, without doors. Fed. Spec WW-P-541, Type II.
- B. Fabricate of stainless steel.
- C. Form face frame from one piece.
- D. Provide removable waste receptacle of approximately 12-gallon capacity, fabricated of stainless steel.
- E. Waste receptacle key locked in place.

2.8 TOILET TISSUE DISPENSERS

- A. Double-roll, surface-mounted type.
- B. Mount on continuous backplate.
- C. Removable spindle ABS plastic or chrome-plated plastic.
- D. Wood rollers are not acceptable.

2.9 GRAB BARS

- A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.
- B. Fabricate of stainless steel.
 - 1. Stainless Steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- C. Concealed mount, except grab bars mounted at floor or swing up.
- D. Bars:
 - 1. Fabricate from 1-1/2-inch outside diameter tubing.
 - a. Stainless steel, minimum 0.0478-inch thick.

2. Fabricate in one continuous piece with ends turned toward walls, except swing up and where grab bars are shown continuous around 3 sides of showers, bars may be fabricated in 2 sections, with concealed slip joint between.
 3. Continuous weld intermediate support to the grab bar.
 4. Swing up bars manually operated. Designed to prevent bar from falling when in raised position.
- E. Flange for Concealed Mounting:
1. Minimum of 0.1046-inch thick, approximately 3-inch diameter by 1/2-inch deep, with provisions for not less than 3 set screws for securing flange to back plate.
 2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.
- F. Flange for Exposed Mounting:
1. Minimum 3/16-inch thick, approximately 3-inch diameter.
 2. Insert grab bar through flange and continuously weld perimeter of grab bar flush to backside of flange.
 3. Where mounted on floor, provide 4 equally spaced holes, sized to accommodate 3/8-inch-diameter bolts, not more than 3/8-inch from edge of flange.
- G. In lieu of providing flange for concealed mounting, and back plate as specified, grab rail may be secured by being welded to a back plate and be covered with flange.
- H. Back Plates:
1. Minimum 0.1046-inch-thick metal.
 2. Fabricate in 1 piece, approximately 1/4-inch deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
 3. Furnish through-bolt fasteners and cap nuts, where grab bars are mounted on solid phenolic or solid polyethylene partitions.

2.10 SHOWER CURTAIN RODS

- A. Stainless-steel tubing, ASTM A569, minimum 0.050-inch wall thickness, 1-1/4-inch outside diameter.
- B. Flanges, stainless-steel rings, 2-5/8-inch minimum outside diameter, with 2 holes opposite each other for 1/4-inch stainless-steel fastening bolts. Provide a set screw within the curvature of each flange for securing the rod.
- C. Intermediate support for rods over 6 feet long. Provide adjustable ceiling flanges with set screws, tubular hangers and stirrups.

2.11 CLOTHES HOOKS - ROBE OR COAT

- A. Fabricate hook units either of chromium-plated brass with a satin finish or stainless steel, using 1/4-inch minimum thick stock, with edges and corners rounded smooth to the thickness of the metal, or 1/8-inch minimum radius.
- B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to the wall flange, provided with concealed fastenings.

2.12 TOWEL BARS

- A. Fed. Spec. WW-P-541/8B, Type IV, Bar, Surface mounted; Class 1, towel.
- B. Either stainless steel or chromium-plated copper alloy.
- C. Bar Length: 18 and 24 inches, as shown.
- D. Finish of brackets or supports same as bar.

2.13 METAL FRAMED MIRRORS

- A. Fed. Spec. A-A-3002 metal frame; stainless steel, Type 302 or 304.
- B. Mirror Glass:
 - 1. Minimum 1/4-inch thick.
 - 2. Set mirror in a protective vinyl glazing tape.
- C. Frames:
 - 1. Channel or angle shaped section with face of frame not less than 3/8-inch wide. Fabricate with square corners.
 - 2. Use 0.0359-inch-thick stainless steel.
 - 3. Filler:
 - a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
 - b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.
- 4. Attached Shelf for Mirrors:
 - a. Fabricate shelf of the same material and finish as the mirror frame.
 - b. Make shelf approximately 5 inches in depth, and extend full width of the mirror.
 - c. Close the ends and the front edge of the shelf to the same thickness as the mirror frame width.
 - d. Form stainless-steel shelf with concealed brackets to attach to mirror frame.

D. Back Plate:

1. Fabricate backplate for concealed wall hanging of either zinc-coated or cadmium-plated 0.036-inch-thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
2. Use set screw type theft-resistant concealed fastening system for mounting mirrors.

E. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.

2.14 MEDICINE CABINETS

A. Fed. Spec. WW-P-541/8B, Type III Medicine cabinets.

1. Mirror Glass: Minimum 3/16-inch thick. Set mirror in a protective vinyl glazing tape.
2. Glass Shelves: Minimum 1/4-inch thick, with bulb-edges at front. Support shelves on adjustable aluminum brackets. Provide 3 shelves to each cabinet.
3. Cabinet Body: Fabricate from 0.036-inch-thick stainless steel. Form body in one piece, without seams, and with rounded inside corners.

B. Hinged Door Type:

1. Class 2, swing door, Style R, recessed.
2. Fabricate mirror door approximately 16 by 22 inches.
3. Cabinet concealed when doors are closed.
4. Mirror Door Frame: Channel shape, 0.036-inch-thick stainless steel.
5. Furnish door with full-length, stainless-steel piano hinge, magnetic or friction catches, rubber bumpers, and a 90-degree restraining arm with spring-type stop.

C. Sliding Door Type:

1. Class 1, slide door, Style R, recessed.
2. Fabricate sliding doors for approximately 26- by 22-inch opening.
3. Provide nylon glides in stainless-steel tracks, door pulls and rubber bumpers.
4. Entire contents of the cabinet concealed when doors closed.

2.15 FOOT-OPERATED SOAP DISPENSER

- A. Wall-mounted liquid soap dispenser, designed with an adjustable needle valve to allow dispensing of 2 milliliters of liquid with each depression of foot pump.
- B. Connect foot pump, by a 6-foot air tube, to a 30-ounce liquid container. Provide air intake tube with a special feature to prevent liquid from dripping after release of pedal.

- C. Operate pump by a slip-resistant, rubber padded pedal.
- D. Complete unit shall not be adversely affected by the liquid soap, aseptic detergent, or hexachlorophene solutions.
- E. Provide a removable gummed label, attached to container, stating that soap or detergent may be used in the dispensers.

2.16 SOAP DISHES

- A. Fed. Spec. WW-P-541/8B, Type VI, Holder.
- B. Class 1, Surface Mounted:
 - 1. One piece with provisions for exposed fasteners.
 - 2. Fabricate from chromium-plated brass approximately 4-1/2 by 3-3/4 inches overall size with drainage openings at bottom.

2.17 PAPER CUP DISPENSER

- A. Fabricate of stainless steel.
- B. Provide door with either concealed stainless-steel pivoting rod or piano hinge, and either spring tension cam lock or tumbler lock, keyed alike when more than one accessory unit is provided and with a cup level refill sight slot in the door front.
- C. Fabricate for flat bottom cups.
- D. 3-ounce Dispenser Unit:
 - 1. Surface-mounted, single-stack dispenser unit having a capacity of approximately 100 cups.
 - 2. Form door from one piece to cover front and sides warp free.
- E. 4-ounce Dispenser Unit:
 - 1. Recessed type single stack dispenser unit having a capacity of approximately 100 cups.
 - 2. Form face frame in one piece.
 - 3. Fabricate door double-pan warp free.
- F. Combination 3- to 6-ounce Dispenser and Disposal Unit:
 - 1. Recessed type, having a capacity of approximately 170 cups.
 - 2. Fabricate as twin-stack dispenser unit with an adjustable dispensing mechanism to dispense any size cup.
 - 3. Fabricate face frames in one piece and doors double pan warp free.
 - 4. Fabricate recessed disposal unit with a removable waste receptacle having a capacity of not less than 3.1 gallons.

2.18 MOP RACKS

- A. Minimum 40 inches long with 5 holders.
- B. Clamps:
 - 1. Minimum of 0.050-inch-thick stainless-steel bracket retaining channel with a hard rubber serrated cam; pivot mounted to channel.

2. Clamps to hold handles from 1/2-inch minimum to 1-1/4-inch maximum diameter.

C. Support:

1. Minimum of 0.0375-inch-thick, stainless-steel, hat-shape channel to hold clamps away from wall as shown.
2. Drill wall flange for 1/8-inch fasteners above and below clamp locations.

- D. Secure clamps to support with oval head machine screws or rivets into continuous reinforcing back of clamps.

- E. Finish on Stainless Steel: AMP 503-No. 4.

2.19 STAINLESS-STEEL SHELVES (TYPE 44)

A. Shelves:

1. Fabricate shelves of 0.0478-inch-thick sheet to size and design shown.
2. Fabricate shelves of hollow metal type construction, forming a depression as shown, with closed fronts, backs, ends and bottoms. Reinforce shelves with 0.0478-inch-thick sheet steel hat channel stiffeners, full depth, welded to underside of top at bracket locations.
3. Miter cuts, where made at corners of shelves, continuously welding.

- B. Form brackets of 1/8-inch-thick steel as shown. Drill brackets for 1/4-inch anchor bolts.

- C. Weld or screw brackets to shelves.

2.20 STAINLESS-STEEL SHELVES, TYPES 45, 45C

- A. Fabricate shelves and brackets to design shown of 0.0478-inch-thick stainless steel.

- B. Round and finish smooth projecting corners of shelves and edge corners of brackets. Drill brackets for 1/4-inch anchor bolts.

- C. Screw or weld brackets to shelves.

2.21 STAINLESS-STEEL SHELVES AT WHEELCHAIR LAVATORY

A. Side-wall Mounted:

1. Fabricate to size and shape shown of 0.0478-inch-thick sheet.
2. Turn up edges and weld corners closed.
3. Fabricate brackets and weld to shelf. Drill brackets for 1/4-inch anchor bolts.

B. Back-wall Mounted:

1. Fabricate to size and shape shown of plate and tube.
2. Turn up edges and weld corners of shelf.

3. Weld tube to back plate and shelf, weld back plate to shelf, filler plate to tube, and corners of shelf with continuous welds.
4. Drill back plate for 1/4-inch anchor bolts.

2.22 DIAPER CHANGING STATION

- A. Wall-mounted, folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 1. Style: Horizontal.
 2. Material: Polyethylene.
 3. Mounting: Surface.
 4. Color: Gray.
 5. Minimum Rated Load: 250 pounds.
 6. Manufacturers:
 - a. American Specialties, Inc.: www.americanspecialties.com.
 - b. Bradley Corporation: www.bradleycorp.com.
 - c. Diaper Deck & Company: www.diaperdeck.com.
 - d. Koala Kare Products: www.koalabear.com.
 - e. Or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before starting work, notify Contracting Officer's Representative (COR) in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the COR the exact location of accessories.

3.2 INSTALLATION

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry. Expansion bolt to concrete or solid masonry.
- C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- D. Install accessories plumb and level and securely anchor to substrate.
- E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
- F. Position and install dispensers and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.

- G. Align mirrors, dispensers and other accessories even and level, when installed in battery.
- H. Install accessories to prevent striking by other moving, items or interference with accessibility.

3.3 SCHEDULE OF ACCESSORIES

- A. As indicated on the Drawings.

3.4 CLEANING

- A. After installation, clean as recommended by the manufacturer and protect from damage until completion of the Project.

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SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section covers recessed fire extinguisher cabinets.

1.2 RELATED WORK

- A. Acrylic Glazing: Section 08 80 00, GLAZING.
B. Field Painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

1.4 APPLICATION PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. American Society of Testing and Materials (ASTM):
D4802-10.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

- A. Recessed type with flat trim of size and design shown.

2.2 FABRICATION

- A. Form body of cabinet from 0.0359-inch-thick sheet steel.
B. Fabricate door and trim from 0.0478-inch-thick sheet steel with all face joints fully welded and ground smooth.
1. Glaze doors with 1/4-inch-thick ASTM D4802, clear acrylic sheet, Category B-1, Finish 1.
2. Design doors to open 180 degrees.
3. Provide continuous hinge, pull handle, and adjustable roller catch.

2.3 FINISH

- A. Finish interior of cabinet body with baked-on semigloss white enamel.
B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
B. Install cabinet so that bottom of cabinet is 39 inches above finished floor.

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SECTION 11 31 00
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes the following:
 - 1. Cooking appliances.
 - 2. Kitchen exhaust ventilation.
 - 3. Refrigeration appliances.
- B. For additional requirements regarding residential appliances and related accessories, see Drawings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed product and for each color and texture.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Field quality-control reports.
- C. Warranties: Sample of special warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

1.6 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Amana; a division of Whirlpool Corporation.
 - 2. ASKO North America; a division of AM Appliance Group.
 - 3. BOSCH Home Appliances.
 - 4. BSH Home Appliances Corporation (Gaggenau).
 - 5. BSH Home Appliances Corporation (Thermador).

6. Dacor, Inc.
7. Dynamic Cooking Systems, Inc.; a subsidiary of Fisher & Paykel Appliances Holdings Limited.
8. Electrolux Home Products (Frigidaire).
9. Fisher & Paykel.
10. General Electric Company (GE).
11. General Electric Company (Hotpoint).
12. Jade Home Products Company.
13. Jenn-Air; a division of Whirlpool Corporation.
14. KitchenAid; a division of Whirlpool Corporation.
15. LG Appliances.
16. Maytag; a division of Whirlpool Corporation.
17. Miele, Inc.
18. Samsung.
19. Sears Brands LLC (Kenmore).
20. Sharp Electronics Corp.
21. Sub-Zero, Inc.
22. Thor Appliance Company.
23. Viking Range Corporation.
24. Whirlpool Corporation.
25. Wolf Appliance, Inc.

2.2 RANGES

- A. Electric Range: Freestanding range with 1 oven and complying with AHAM ER-1.
 1. Electric Burner Elements: Four radiant type burners.
 2. Anti-Tip Device: Manufacturer's standard.
 3. Material: Stainless steel with manufacturer's standard ceramic-glass cooktop.

2.3 MICROWAVE OVENS

- A. Microwave Oven:
 1. Mounting: Under cabinet.
 2. Capacity: 2.0 cu. ft.
 3. Exhaust Fan: Vented to outside and with manufacturer's standard capacity.
 4. Microwave Power Rating: 1,000W.
 5. Material: Stainless steel.
- B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

2.4 REFRIGERATOR/FREEZERS

- A. Refrigerator/Freezer: Two-door refrigerator/freezer with freezer on bottom and complying with AHAM HRF-1.
 - 1. Type: Freestanding.
 - 2. Storage Capacity:
 - a. Refrigeration Compartment Volume: 15.6 cubic feet.
 - b. Freezer Volume: 5.13 cubic feet.
 - 3. General Features:
 - a. Dispenser in door for ice and cold water.
 - b. Interior light in refrigeration compartment.
 - c. Automatic defrost.
 - d. Interior light in freezer compartment.
 - e. Automatic icemaker and storage bin.
 - 4. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
 - 5. Front Panel(s): Stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- C. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.
- D. Utilities: Comply with plumbing and electrical requirements.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.

2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 3. Operational Test: After installation, start units to confirm proper operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- C. Prepare test and inspection reports.

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SECTION 12 32 00
MANUFACTURED WOOD CASEWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies plastic laminate casework as detailed on the Drawings, including related components and accessories required to form integral units. Wood casework items shown on the Drawings, but not specified below shall be included as part of the Work under this Section, and applicable portions of the Specification shall apply to these items. Each like item of casework shall be of the same design and by one manufacturer.
- B. Where shown, provide plastic laminate casework items including base cabinets, countertops, and wall cabinets, as shown on the Drawings.

1.2 RELATED WORK

- A. Color and Finish of Plastic Laminate: As shown on the Finish Schedule on the Drawings.

1.3 MANUFACTURER'S QUALIFICATIONS

- A. The fabrication of casework shall be by a manufacturer who produces casework similar to the casework specified and shown.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Sinks, trim and fittings.
 - 2. Locks for doors and drawers.
 - 3. Adhesive cements.
- C. Samples: Countertop, plastic laminate, 6-inch square.
- D. Shop Drawings (1/2 fullsize):
 - 1. All casework, showing details of construction, including materials, hardware and accessories.
 - 2. Cabinets and counters showing faucets in connection with sink bowls, and electrical fixtures and receptacles which are mounted on cabinets and counters.
 - 3. Fastenings and method of installation.
- E. Mock-Up: Where required for special casework and where 4 or more similar units are involved, submit a mock-up of a typical unit for approval by Contracting Officer's Representative (COR).

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A167-99 (R2009).....Stainless and Heat-Resisting chromium-Nickel Steel Plate, Sheet and Strip
 - A1008-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy
 - C1036-06.....Flat Glass
- C. U.S. Department of Commerce Product Standards (Prod. Std):
 - PS1-95.....Construction and Industrial Plywood
- D. Hardwood, Plywood and Veneer Association (HPVA):
 - HP-1-09.....Hardwood and Decorative Plywood
- E. Architectural Woodwork Institute (AWI):
 - Architectural Woodwork Quality Standards, Guide Specifications Quality Certification Program - 1999
- F. American Society of Mechanical Engineers (ASME):
 - A112.18.1-05.....Plumbing Fixture Fittings
- G. National Electrical Manufacturers Association (NEMA):
 - LD3-05.....High Pressure Decorative Laminates
 - LD3.1-95.....Performance, Application Fabrication and Installations of High-Pressure Decorative Laminates

PART 2 - PRODUCTS

2.1 PLASTIC LAMINATE

- A. NEMA LD-3.
- B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General purpose Type HGL.
- C. Cabinet Interiors Including Shelving: Both of following options to comply with NEMA, LD3.1 as a minimum.
 - 1. Plastic-laminate-clad plywood.
- D. Backing sheet on bottom of plastic laminate covered wood tops. Backer Type BKL.
- E. Post-Forming Fabrication, Decorative Surface: Post-forming Type HGP.

2.2 PLYWOOD, SOFTWOOD

- A. Prod. Std. PS1, 5-ply construction from 1/2-inch to 1-1/8-inch thickness, and 7-ply for 1-1/4-inch thickness.

2.3 PARTICLEBOARD

- A. The use of particleboard is not allowed.

2.4 RUBBER OR VINYL BASE

- A. Unless otherwise indicated on the Drawings, furnish straight (for carpet), cove (for resilient floor); 4-inch-high, 1/8-inch-thick, flexible to conform to irregularities in walls, partitions and floors.

2.5 PLUMBING FIXTURES

- A. ASME A112.18.1, except die-cast zinc-alloy material is not acceptable.

2.6 GLASS: ASTM C1036

- A. For Doors: Type I, Class 1, Quality q4.

2.7 SHEET STEEL

- A. ASTM A1008.

2.8 STAINLESS STEEL

- A. ASTM A167, with No. 4 finish.

2.9 HARDWARE

- A. Where pin tumbler locks are specified, furnish locks with 7-pin removable cylinder cores tied to the door hardware locking system by Yale Hardware as specified under Section 08 71 00 - DOOR HARDWARE. Locks for each type of casework shall be keyed differently and shall be master-keyed for each type service, such as Nurses, Psychiatric, and Administration. Provide 2 keys for each lock. Exposed hardware, except as otherwise specified, shall be satin-finished, chromium-plated brass or nickel-plated brass.
- B. Marking of Locks and Keys:
 - 1. The name of the manufacturer, or trademark by which manufacturer can readily be identified, legibly marked on each lock.
 - 2. The key change number marked on the exposed face of lock, and also stamped on each key.
 - 3. Key change numbers shall provide sufficient information for replacement of the key by the manufacturer.
- C. Hinged Doors:
 - 1. Doors 36 inches and more in height shall have 3 hinges and doors less than 36 inches in height shall have 2 hinges. Each door shall close against 2 rubber bumpers.
 - 2. Hinges: Fabricate hinges with minimum 0.072-inch-thick chromium-plated steel leaves, and with minimum 0.139-inch-diameter stainless-steel pin. Hinges shall be 5-knuckle design with 2-1/2-inch-high leaves and hospital type tips.

3. Fasteners: Provide full-thread wood screws to fasten hinge leaves to door and cabinet frame. Finish screws to match finish of hinges.
- D. Door Catches:
 1. Friction or Magnetic type, fabricated with metal housing.
 2. Provide 1 catch for cabinet doors 48 inches high and under, and 2 for doors over 48 inches high.
- E. Locks:
 1. Cylinder type pin tumbler.
 2. Equip doors and drawers where shown with locks as specified under paragraph 2.9 A. of this Section.
- F. Drawer and Door Pulls: Doors and drawers shall have wire pulls, per BO2001, fabricated of either chromium-plated brass, chromium-plated steel, stainless steel, or anodized aluminum.
- G. Drawer Slides:
 1. Full extension steel slides with nylon ball-bearing rollers.
 2. Slides shall have positive stop.
 3. Equip drawers with rubber bumpers.
- H. Shelf Standards (Except For Fixed Shelves): Bright zinc-plated steel for recessed mounting with screws, 5/8-inch-wide by 3/16-inch-high providing 1/2-inch adjustment, complete with shelf supports.
- I. Gate Bolt: Surface-mounted barrel type with strike.
- J. Hinged Gates: Gates shall have two double-acting hinges or pivots, size as required.

2.10 FABRICATION

- A. Casework shall be of the flush overlay design and, except as otherwise specified, be of premium grade construction and of component thickness in conformance with AWI Quality Standards.
- B. Fabricate casework of plastic-laminated covered plywood as follows:
 1. Where shown, gates, doors, drawers, shelves, and all semi-concealed surfaces shall be plastic laminated.
 2. Glazed doors shall have 3/16-inch-thick glass, set in glazing compound.
- C. Electrical fixtures, receptacles, wiring and junction boxes required for fixtures and receptacles:
 1. Factory installed in casework.
 2. For electrical lighting fixtures, see Drawings.
 3. For electric receptacles and lighting fixtures installed below or adjacent to wall cabinets or above countertops, see Electrical Sections of Specifications.

4. Install wiring in built-in raceways and terminate at junction box mounted on rear of cabinet and counter.
5. For final hook-up at junction box see Electrical Sections of Specifications.

D. Base:

1. Provide rubber or vinyl base with close, flush joints; set with adhesive.
2. Remove adhesive from exposed surfaces.
3. Install base at floor line after casework has been accurately leveled.
4. Rub base to glossy finish.

E. Countertops:

1. Countertops, splashbacks, and reagent type shelves shall be plastic laminate factory glued to plywood (PS1) core.
2. Countertops shall be 1-1/4 inches thick.
3. Splashbacks and reagent type shelves shall be finished 3/4-inch thick and be secured to countertops with concealed metal fastenings and with contact surfaces set in waterproof adhesive.
4. Provide cut-outs for plumbing trim where shown.
5. Cover exposed edges of countertops, splashbacks, and reagent type shelves with plastic.

F. Sink Bowls:

1. 18-gage stainless steel, of size and design shown.
2. All interior corners of bowls shall be formed to manufacturer's standard radii.
3. Sinks shall have rims with flanged edges overlapping tops to provide tight joints.
4. Secure sink bowls with concealed fastenings.
5. For service lines from service fixtures, see other sections of specifications.

G. Provide the following plumbing trim and fittings:

1. Faucets: ASME A112.18.1 Type I, compression type, countertop-mounted, chromium-plated brass, having 2 valves and with swing-spout and gooseneck spout as shown, elevated to clear handles.
2. Fittings shall have an elongated escutcheon for spout and handles, replaceable valve seats and 4 arm or lever style indexed chromium-plated brass or stainless-steel handles; handles either with or without hood.

H. Faucets:

1. ASME A112.18.1 Type I, compression type, splashback-mounted, chromium-plated brass, having 2 valves and with swing-spout and/or gooseneck spout as indicated.
2. Fittings shall have exposed body union inlets and adjustable flanges.
3. Valves shall have indexed chromium-plated brass or stainless-steel lever handles and replaceable valves seats; handles either with or without hood.

I. Drain:

1. Cast or wrought brass or stainless steel with flat strainer.
2. Surfaces of drains exposed from above shall have a chromium-plated finish.

J. Traps: Cast brass.

K. Spray Hose:

1. Hose shall drop below countertop when not in use and be of sufficient length to reach the entire length of the countertop.
2. Concealed trim may be rough brass.

L. Support Members for Tops of Tables:

1. Construct as detailed.
2. Provide miscellaneous steel members and anchor as shown.

M. Legs for Counters:

1. Fabricate legs for counters of 0.0635-inch-thick, 1-1/2-inch-square tubular stainless steel where shown.
2. Secure legs to countertops and provide legs at bottom with shoes not less than 1 inch in height.
3. Fabricate shoes of either stainless steel, aluminum or chromium-plated brass.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set casework in place; level, plumb and accurately scribe and secure to walls, and/or floors.
- B. The installation shall be complete including all trim and hardware. Leave the casework clean and free from defects.

3.2 FASTENINGS

- A. Fastenings for securing casework to adjoining construction shall be as detailed on the Drawings or approved shop drawings.
- B. See Section 05 50 00, METAL FABRICATIONS for reinforcement of walls and partitions for casework anchorage.

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SECTION 12 36 00
COUNTERTOPS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies casework countertops with integral accessories.
- B. Integral Accessories Include:
 - 1. Sinks with traps and drains.
 - 2. Electrical Receptacles.
 - 3. Pegboards.

1.2 RELATED WORK

- A. DIVISION 22, PLUMBING.
- B. DIVISION 26, ELECTRICAL.
- C. Equipment Reference Manual for SECTION 12 36 00, COUNTERTOPS.

1.3 SUBMITTALS

- A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Show dimensions of section and method of assembly.
 - 2. Show details of construction at 1/2 scale.
- C. Samples:
 - 1. 6-inch-square samples, each top.
 - 2. Front edge, backsplash, end splash and core with surface material and booking.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Hardboard Association (AHA):
 - A135.4-95.....Basic Hardboard
- C. American Society of Mechanical Engineers (ASME):
 - A112.18.1-12.....Plumbing Supply Fittings
 - A112.1.2-12.....Air Gaps in Plumbing System
 - A112.19.3-08 (R2004).....Stainless-Steel Plumbing Fixtures (Designed for Residential Use)
- D. American Society for Testing and Materials (ASTM):
 - A167-99 (R2009).....Stainless- and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

- A1008-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural,
High-Strength, Low Alloy
- D256-10.....Pendulum Impact Resistance of Plastic
- D570-98 (R2005).....Water Absorption of Plastics
- D638-10.....Tensile Properties of Plastics
- D785-08.....Rockwell Hardness of Plastics and Electrical
Insulating Materials
- D790-10.....Flexural Properties of Unreinforced and
Reinforced Plastics and Electrical Insulating
Materials
- D4690-99 (2005).....Urea-Formaldehyde Resin Adhesives
- E. Federal Specifications (FS):
 - A-A-1936.....Adhesive, Contact, Neoprene Rubber
- F. U.S. Department of Commerce, Product Standards (PS):
 - PS 1-95.....Construction and Industrial Plywood
- G. National Electrical Manufacturers Association (NEMA):
 - LD 3-05.....High-Pressure Decorative Laminates

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A167, Type 304.
- B. Sheet Steel: ASTM A1008, cold-rolled, Class 1 finish, stretcher leveled.
- C. Plywood: PS 1, exterior type, veneer Grade AC not less than 5-ply construction.
- D. Hardboard: ANSI/AHA A135.4, Type I, tempered, fire-retardant treated, smooth surface one side.
- E. Adhesive:
 - 1. For Wood Products: ASTM D4690, unextended urea resin or unextended melamine resin, phenol resin, or resorcinol resin.
 - 2. For Field Joints:
 - a. Epoxy type, resistant to chemicals as specified for plastic laminate laboratory surfaces.
 - b. Fungi Resistant: ASTM G-21, rating of 0.
- F. Fasteners:
 - 1. Metals used for welding same metal as materials joined.
 - 2. Use studs, bolts, spaces, threaded rods with nuts or screws suitable for materials being joined with metal splice plates, channels or other supporting shape.

2.2 SINKS

- A. Stainless Steel:

1. ANSI/ASME A112.19.3, Type 304.
2. Self rim for plastic laminate or similar tops with concealed fasteners.
3. Flat rim for welded into stainless-steel tops.
4. Ledge back or ledge sides with holes to receive required fixtures when mounted on countertop.
5. Apply fire-resistant sound-deadening material to underside.

C. Stainless-steel sink as shown on the Drawings.

2.3 TRAPS AND FITTINGS

A. Material as specified in DIVISION 22, PLUMBING.

B. For Stainless-Steel Sinks:

1. Either cast or wrought brass or stainless-steel P-traps and drain fittings; ASME A112.18.1
2. Flat strainer, except where cup strainer or overflow standpipe specified.
 - a. Provide cup strainer in Cabinet Type 1B.
 - b. Provide stainless-steel overflow stand pipe to within 1-1/2 inches of sink rim.
3. Exposed surface chromium plated finish.

2.4 WATER FAUCETS

A. ASME A112.18.1.

1. Cast or forged brass, compression type with replaceable seat and stem assembly or replaceable cartridge.
2. Indexed lever handles either with or without head.
3. Gooseneck minimum clearance above countertop of 7-1/2 inches, bent 180 degrees for vertical discharge.
4. Swing spouts elevated to clear handles.
5. Exposed brass surfaces, chromium plated.
6. Cast combination hot and cold fixture with 1-piece body for multiple outlets.
7. Adapter type connection which will permit field conversion of swing spouts to fixed or gooseneck grouts or vice versa.

2.5 FIXTURE IDENTIFICATION

A. Code fixtures with full-view plastic index buttons.

B. Use Following Colors and Codes:

SERVICE	COLOR	CODE	COLOR OF LETTERS
Cold Water	Dark Green	CW	White
Hot Water	Red	HW	White

SERVICE	COLOR	CODE	COLOR OF LETTERS
Laboratory Air	Orange	AIR	Black
Fuel Gas	Dark Blue	GAS	White
Laboratory Vacuum	Yellow	VAC	Black
Distilled Water	White	DW	Black
Deionized Water	White	DI	Black
Oxygen	Light Green	OXY	White
Hydrogen	Pink	H	Black
Nitrogen	Gray	N	Black
All Other Gases	Light Blue	CHEM. SYM.	Black

2.6 ELECTRICAL RECEPTACLES

- A. Hospital grade per Electrical Specifications.
- B. Curb-Mounted Receptacles:
 - 1. NEMA 5-20R duplex in galvanized steel box.
 - 2. Chromium-plated brass or steel face plate.
- C. Pedestal-Mounted Receptacles:
 - 1. NEMA 5-20R duplex installed in double faces.
 - 2. Polished stainless-steel or aluminum, or chromium-plated brass pedestal.

2.7 COUNTERTOPS

- A. Fabricate in largest sections practicable.
- B. Fabricate with joints flush on top surface.
- C. Fabricate countertops to overhang front of cabinets and end of assemblies 1 inch except where against walls or cabinets.
- D. Provide countertops with bullnose front edge as shown on Drawings.
- E. Provide 0.039-inch-thick metal plate connectors or fastening devices.
- F. Join edges by welding metal tops.
- G. Fabricate with end splashes where against walls or cabinets.
- H. Splash Backs and End Splashes:
 - 1. Not less than $\frac{3}{4}$ -inch thick.
 - 2. Height 4 inches unless noted otherwise.
- I. Drill or cut out for sinks and penetrations.
 - 1. Accurately cut for size of penetration.
- J. Metal Countertops:
 - 1. Fabricate up to 12 feet long in 1 piece, including nosing, backs and ends.

2. When countertops exceed 12 feet in length, accurately fitted field joints are acceptable.
3. Finish thickness at edges 1-1/4 inches.
4. Reinforced with minimum 0.0598-inch-thick hat channel stiffeners, minimum of 2 stiffeners for units without sinks and 3 stiffeners for units with sinks welded or soldered to underside of top full length, except at sink openings.
5. Apply sound deadening material on underside.
6. Flange edges of tops down 1-1/4 inches, and reinforce with concealed hardwood or with a steel frame.
7. Grind welds smooth and finished on exposed surfaces to match finish specified.
8. Stainless-Steel Counter or Sink Tops:
 - a. Where noted, stainless steel except where specified for nourishment unit, unit kitchen, and medicine cabinet.
 - b. Use 0.0598-inch-thick stainless steel.
 - c. Depth of splash backs and splash ends 1 inch and turned down at least 1/2-inch at wall. Where faucets are located in splash backs, fabricate depth of splash backs 2 inches with provision made to receive required fixture.
 - d. Where sinks occur, fabricate top with 3/16-inch marine edge and fit flush with adjacent tops of other materials.
 - e. Weld sink flush to countertop and finish to appear seamless.

K. Pegboards:

1. Pegboard: Fabricate of birch with black acid-resisting finish and equip with polypropylene or unfinished hardwood pegs.
2. Pegboard with Funnel and Graduate Rack: Fabricate of birch with black acid-resisting finish and equip with polypropylene or unfinished hardwood pegs. Support rack on steel brackets. Provide CRS gutter and drain to sink.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before installing countertops, verify that wall surfaces have been finished as specified and that mechanical and electrical service locations are as required.
- B. Secure countertops to supporting rails of cabinets with metal fastening devices, or screws through pierced slots in rails.

1. Where type, size or spacing of fastenings is not shown or specified, submit shop drawings showing proposed fastenings and method of installation.

2. Use round head bolts or screws.

C. Sinks:

1. Install stainless-steel sink in plastic laminate tops with epoxy compound to form watertight seal under shelf rim.
 - a. Fit stainless-steel sink with overflow standpipe.
 - b. Install faucets and fittings on sink ledges with watertight seals where shown.

D. Faucets, Fixtures, and Outlets:

1. Seal opening between fixture and top.
2. Secure to top with manufacturer's standard fittings.

F. Electrical Outlets:

1. Set in cutouts with manufacturer's gasket sealing joint with top to prevent water leakage.
2. Install control unit and electric outlets where shown. Seal escutcheon plate at lap if on counter or top to prevent water leakage.

3.2 PROTECTION AND CLEANING

- A. Tightly cover and protect against dirt, water, and chemical or mechanical injury.
- B. Clean at completion of Work.

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SECTION 21 05 11
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 21.
- B. Definitions:
 - 1. Exposed: Piping and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Excavation and Backfill: Section 31 20 00, EARTH MOVING.
- D. Concrete and Grout: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- E. Building Components for Attachment of Hangers: Section 05 31 00, STEEL DECKING.
- F. Section 05 50 00, METAL FABRICATIONS.
- G. Section 07 84 00, FIRESTOPPING.
- H. Flashing for Wall and Roof Penetrations: Section 07 60 00, FLASHING AND SHEET METAL.
- I. Section 07 92 00, JOINT SEALANTS.
- J. Section 09 91 00, PAINTING.
- K. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS
- L. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS
- M. Section 21 05 12, GENERAL MOTOR REQUIREMENTS FOR FIRE-SUPPRESSION EQUIPMENT.
- N. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

- A. Products Criteria:
 - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
 - 2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.
 - 3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
 6. Asbestos products or equipment or materials containing asbestos shall not be used.
- B. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- C. Guaranty: In GENERAL CONDITIONS.
- D. Supports for sprinkler piping shall be in conformance with NFPA 13.
- E. Supports for standpipe shall be in conformance with NFPA 14.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
1. Equipment and materials identification.
 2. Fire-stopping materials.
 3. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
 4. Wall, floor, and ceiling plates.
- C. Coordination Drawings: Provide details of the following.
1. Mechanical equipment rooms.
 2. Interstitial space.
 3. Hangers, inserts, supports, and bracing.
 4. Pipe sleeves.
 5. Equipment penetrations of floors, walls, ceilings, or roofs.
- D. Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.

2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-2001.....Carbon Structural Steel
 - A575-96.....Steel Bars, Carbon, Merchant Quality, M-Grades R (2002)
 - E84-2003.....Standard Test Method for Burning Characteristics of Building Materials
 - E119-2000.....Standard Test Method for Fire Tests of Building Construction and Materials
- C. National Fire Protection Association (NFPA):
 - 90A-96.....Installation of Air Conditioning and Ventilating Systems
 - 101-97.....Life Safety Code

PART 2 - PRODUCTS

2.1 LIFTING ATTACHMENTS

Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.2 ELECTRIC MOTORS

- A. Section 21 05 12, GENERAL MOTOR REQUIREMENTS FOR FIRE-SUPPRESSION EQUIPMENT, specifies the applicable requirements for electric motors. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements.
- B. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).
- C. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.
- D. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 40 degrees centigrade (104 degrees F); minimum horsepower

as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.

- E. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.3 VARIABLE SPEED MOTOR CONTROLLERS

- A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS for specifications.
- B. The combination of controller and motor shall be provided by the respective pump manufacturer, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. pumps, shall be product of a single manufacturer.
- C. Motors shall be energy efficient type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.
- D. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.

2.4 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.
- D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.
- E. Valve Tags and Lists:
 - 1. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4

- mm(1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
2. Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
 3. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

2.5 FIRESTOPPING

Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping.

2.6 GALVANIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

AK2.7 PIPE PENETRATIONS

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
 1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirement must receive prior approval of Resident Engineer.
- D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.

- G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
- H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.
- I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.8 TOOLS AND LUBRICANTS

- A. Furnish, and turn over to the Resident Engineer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.9 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate location of piping, sleeves, inserts, hangers, and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Protection and Cleaning:
 - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
 - 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water, chemical, or mechanical injury. At completion of all work thoroughly exposed materials and equipment.
- C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Install gages, valves, and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- E. Work in Existing Building:
 - 1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
 - 2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
 - 3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Resident Engineer. Locate openings that will least effect structural slabs,

columns, ribs or beams. Refer to the Resident Engineer for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Resident Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

- F. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.
- G. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- H. Inaccessible Equipment:
 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 MOTOR AND DRIVE ALIGNMENT

- A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.
- B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.3 LUBRICATION

Field check and lubricate equipment requiring lubrication prior to initial operation.

3.4 STARTUP AND TEMPORARY OPERATION

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.5 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.

- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.6 INSTRUCTIONS TO VA PERSONNEL

Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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SECTION 21 10 00
WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The design and installation of a hydraulically calculated automatic fire sprinkler system complete and ready for operation, for the entire renovation including the penthouse, mechanical equipment rooms, attic space, elevator machine rooms, elevator pits, linen and trash chutes, and accessible shafts.
- B. Installation of new sectional valves in the sprinkler system feed mains as indicated on the drawings.
- C. Modification of the existing sprinkler system as indicated on the drawings. Size system by pipe schedule in accordance with NFPA 13 and NFPA 14 the latest editions.
- D. Provide access doors or panels where control or drain valves are located behind plaster or gypsum walls or ceilings as necessary to install piping above suspended plaster or gypsum ceilings.
- J. Painting of exposed piping and supports to follow Section 09 91 00, PAINTING.

1.2 RELATED WORK

- A. Treatment of penetrations through rated enclosures: Section 07 84 00, FIRESTOPPING.
- B. Access panels for plaster ceilings: Section 08 31 13, ACCESS DOORS AND FRAMES.
- C. Painting of exposed pipe: Section 09 91 00, PAINTING.
- D. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION.
- E. Alarm Supervision: Section 28 31 00, FIRE DETECTION AND ALARM.
- F. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 DESIGN CRITERIA

- A. The design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system shall be in accordance with the required advisory provisions of NFPA 13.

Exception to NFPA Fire Codes are as follows:

- 1. Sprinklers are not required in interstitial areas, except along AGV track systems if the vehicle is combustible.

B. Base system design hydraulic calculations using the area/density method on the following criteria and in accordance with NFPA 13 latest edition.

1. Sprinkler Protection:

- a. All patient care, sleeping, treatment, office, waiting areas, educational areas, dining areas, corridors and attics: Light hazard, (0.10 gpm/sq. ft.) over the hydraulically most remote 140 m² (1500 sq. ft.).
 - b. Kitchen, Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Elevator Shafts (if required), Elevator Machine Rooms, Refrigeration Service Rooms, and storage between 9 and 23 m² (100 and 250 sq. ft.): Ordinary Hazard, Group 1, 6.1 L/minute/m² (0.15 gpm/sq. ft.) over the hydraulically most remote 140 m² (1500 sq. ft.).
 - c. Clean and soiled linen rooms, trash rooms, clean and soiled utility rooms, laundry, laboratories, retail sales and storage rooms, storage room over 23 m² (250 sq. ft.), boiler plants, loading docks, warehouse spaces, energy centers, Pharmacy and SPD areas: Ordinary Group 2, 8.1 L/minute/m² (0.20 gpm/sq. ft.) over the hydraulically most remote 140 m² (1500 sq. ft.).
 - d. File Storage Areas with "Rolling Files" Racks: Ordinary Group 2 for the entire area of the space up to 140 m² (1500 sq. ft.) area of sprinkler operation.
 - e. Supply warehouse with storage height less than 3650 mm (12 ft. high): Ordinary Hazard Group 2. Storage height exceeding 3650 mm (12 ft.), per NFPA 13 latest edition.
 - f. Provide sprinklers in accessible shafts per NFPA 13 latest edition.
 - g. Provide sprinklers in gravity type metal chutes per NFPA 82.
2. Add water allowance of 15 L/s (250 gpm) for inside and outside hose streams to the sprinkler requirements at the connection to the distribution main.
3. Hydraulic Calculations: The calculated demand including hose stream requirements shall fall no less than 10 percent below the available supply curve.
4. Water Supply:
- a. Elevation of static and elevation of residual test gage: 600 mm (2 ft.) above site grade

- b. Static pressure: _____ kPa (psi)
- c. Residual pressure: _____ kPa (psi)
- d. Flow: _____ L/s (gpm)
- e. Date:_____ Time:_____
- C. For each sprinkler zone provide a control valve, flow switch, self-contained test, drain assembly and pressure gage.
- D. Provide a separate sprinkler valve for each traction elevator machine room and other areas as required by NFPA 13 latest edition.
- E. Provide a guard for each sprinkler in the janitors' closets, the elevator machine room and sprinklers within 2100 mm (7 ft.) of the floor and other areas as required by NFPA 13.
- F. Locate sprinklers in patient bedrooms assuming all privacy curtains have 13 mm (1/2 in.) openings in mesh extending 450 mm (18 in.) from ceiling.
- G. Seismic Protection: Seismically brace all new and existing piping systems in accordance with Zone _____ of NFPA 13 latest edition.

1.4 QUALIFICATIONS:

- A. Designer's Qualifications: Design work and shop drawings shall be prepared by a licensed engineer practicing in the field of Fire Protection Engineering or a NICET (National Institute for Certification in Engineering Technologies) Level III sprinkler technician.
- B. Installer's Qualifications: The installer shall possess a valid State fire protection contractor's license. The installer shall provide documentation of having successfully completed three projects of similar size and scope.
- C. On-site emergency service within four hours notification.

1.5 SUBMITTALS

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sprinkler design shall be done by a certified professional. All plans shall be stamped by qualified P.E.
- C. Emergency service point of contact name and 24 hour emergency telephone number.
- D. Manufacturer's Literature and Data:
 - 1. Pipe and fittings.
 - 2. Valves
 - 3. Drips
 - 4. Sprinklers-each type, temperature and model

5. Inspectors Test Alarm Modules
 6. Sprinkler Plugs
 7. Pressure Gages
 8. Pressure Switches
 9. Pipe Hangers and Supports
 10. Water Flow Switches
 11. Valve Tamper Switches
 16. Water Measuring Device
 17. Valve Cabinet
- E. Detailed drawings in accordance with NFPA 13 the latest editions.
Drawings shall be prepared using CADD software stamped by fire protection professional engineer and include all new and existing sprinklers and piping. Use format in use at the VA medical center. Drawings are subject to change during the bidding and construction periods. Any wall and ceiling changes occurring prior to the submittal of contractors shop drawings shall be incorporated into the contractors detailed design at no additional contract cost.
- F. Hydraulic calculations for each sprinkler system in accordance with NFPA 13 latest edition.
- G. Operation and Maintenance Data:
1. Indicating Valves
 2. Water Flow and valve tamper switches
 3. Alarm Valves
 4. Pre-action Valves
 5. Air Compressor
 6. Fire Pump
 7. Excess Pressure Pump
 8. Copy of NFPA 25
- H. Recommended preventive maintenance schedule.

1.6 AS-BUILT DOCUMENTATION

- A. A Mylar as-built drawing and two blueline copies shall be provided for each drawing. One copy of final CADD drawing files shall also be provided on 89 mm (3 1/2 in.), 1.44 mb diskette, for each drawing.
Really?
- B. Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- C. Four sets of hydraulic calculations for each sprinkler system updated to include submittal review comments and any changes to the

installation which affect the calculations including one electronic set in PDF format.

- D. Four copies of the hydrostatic report and NFPA 13 material and test certificate for each sprinkler system.
- E. Four sets of operation and maintenance data updated to include submittal review comments and any equipment substitutions including one copy of NFPA 25.
- F. Manufacturers literature, hydraulic calculations, reports and operation and maintenance data shall be in a labeled 3-ring binder.

1.7 WARRANTY

- A. All work performed and materials and equipment furnished under this contract shall be free from defects for a period of one year from date of acceptance by the government.
- B. All new piping and equipment incorporated into the new system shall be hydrostatically tested and warranted as new.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA)
 - 13-2010.....Installation of Sprinkler Systems
 - 14-2010.....Installation of Standpipe and Hose Systems
 - 17A-2009.....Standard for wet chemical extinguishing systems
 - 20-2003.....Installation of Centrifugal Fire Pump
 - 24-2010.....Installation of Private Fire Service Mains and
Their Appurtenances
 - 25-2011.....Inspection, Testing and Maintenance of water
Based Fire Protection Systems
 - 70-2011.....National Electrical Code
 - 72-2010.....National Fire Alarm Code
 - 82-2009.....Incinerators, Waste and Linen Handling Systems
and Equipment
 - 170-2009.....Standards for Fire Safety Symbols
 - 291-2010.....Fire Flow Testing and Marking of Hydrants
- C. Underwriters Laboratories Inc. (UL)
 - 2011.....Fire Protection Equipment Directory
- D. Factory Mutual Engineering Corporation (FM)
 - 2010.....Approval Guide

- E. American Society for Testing and Materials (ASTM)
F442-09.....Chlorinated Poly (Vinyl Chloride) (CPVC)
Plastic Pipe
- F. American Society of Sanitary Engineering (ASSE)
1015-2009.....Double Check Backflow Prevention Assembly
- G. Not Used.
- H. Contractor shall provide all necessary test equipment, parts and labor to perform required maintenance.
- I. All inspections, testing and maintenance work required by NFPA 25, NFPA 20, NFPA 13 and recommended by the equipment manufacturer shall be provided. Work shall include operation of sprinkler system alarm and supervisory devices.
- J. Maintenance and testing shall be performed on a quarterly basis. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment, and cleaning of all equipment.
- K. Non-included Work: Maintenance service shall not include the performance of any work due to improper use, accidents or negligence for what the contractor is not responsible.
- L. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of work performed and parts replaced shall be provided.
- M. Emergency Service:
 - 1. Normal and overtime emergency call-back service shall consist of an on-site response to calls within four hours of notification.
 - 2. Overtime emergency call-back service shall be limited to minor adjustments and repairs to affect the integrity of the system.
 - 3. The sprinkler system must be operational before the responding service person leaves the facility.

PART 2 - PRODUCTS

2.1 GENERAL

All devices and equipment shall be Underwriters Laboratories Inc. listed for their intended purpose. All sprinklers shall be Factory Mutual approved.

2.2 PIPING AND FITTINGS

- A. Pipe and fittings from inside face of building 300 mm (12 in.) above finished floor to a distance of approximately 1500 mm (5 ft.) outside building: Ductile Iron, flanged fittings and 316 stainless steel bolting.
- B. Fire Protection water supply within the building up to sprinkler system isolation valves shall be black steel, per NFPA 13.
- C. Sprinkler piping downstream of the isolation valve on wet-pipe systems shall be black steel.
- D. Sprinkler piping of a dry pipe system shall be galvanized. Schedule 40 minimum.
- E. MRI Suite: Copper.
- F. Threaded or flanged fittings shall be ANSI B1 6.3 cast iron, class 125 minimum. Threaded fittings are not permitted on pipe with wall thickness less than schedule 40.
- G. All fittings on galvanized piping shall be galvanized in accordance with ASTM A53.
- H. Slip type or clamp-on type rubber gasketed fittings shall be listed for each piping application.
- I. Piping Materials Standards:
 - 1. Ferrous piping - follow ASTM A 795 Standard
 - 2. Welded and seamless steel pipe - follow ANSI/ASTM A 53
 - 3. Wrought steel pipe - follow ANSI/ASME B36.10M
 - 4. Electric resistance welded steel pipe - follow ASTM A 135
 - 5. Seamless copper tube - follow ASTM B 75
 - 6. Seamless copper water tube - follow ASTM B 88
 - 7. Wrought seamless copper and copper alloy tube - follow ASTM B 251
 - 8. Fluxes for soldering applications of copper and copper alloy tube - follow ASTM B 813
 - 9. Brazing filler metal - follow AWS A5.8
 - 10. Solder metal, 95-5 - follow ASTM B 32
 - 11. Alloy material - follow ASTM B 446
 - 12. Non-metallic piping CPVC pipe - follow ASTM F 442
- J. Fitting Materials Standards:
 - 1. Cast iron threaded fitting, Class 125 and 250 - follow ASME B16.4
 - 2. Cast iron pipe flanges and flanged fittings - follow ASME B16.1
 - 3. Malleable iron threaded fittings, Class 150 and 300 steel - follow ASME B16.3

4. Factory made wrought steel buttweld fittings - follow ASME B16.9
5. Buttwelding ends for pipe, valves, flanges, and fitting - follow ASME B16.25
6. Wrought copper and copper alloy solder joint pressure fittings - follow ASME B16.22
7. Cast copper alloy solder joint pressure fitting - follow ASME B16.18
8. Chlorinated polyvinyl chloride (CPVC) - follow ASTM F 437
- K. Pipe Identification - All pipe, including specially listed pipe allowed by NFPA 13, shall be marked continuously along its length by the manufacturer in such a way as to properly identify the type of pipe. Pipe identification shall include the manufacturer's name, model designation, or schedule.

2.3 VALVES

A. Listed Indicating Valves:

1. Gate: OS&Y, 2400 kPa (350 psi) - Water Working Pressure (WWP) .
2. Butterfly: Gear operated, indicating type, 2400 kPa (350 psi) water working pressure (WWP). Butterfly valves are to be installed in a manner that does not interfere with the operation of any system component.
3. Ball (inspectors test and drain only): iron body, stainless steel trim, for 2050 kPa (300 psi) service, indicating type.
4. Ball and butterfly valves shall not be used on incoming water service, and on the suction side of either the fire pump or jockey pump.

B. Check Valves: Swing type, rubber faced or wafer type spring loaded butterfly check valve, 2400 kPa (350 lb.) water working pressure (WWP).

C. Alarm Check: Iron body, bronze mounted, variable pressure type with retarding chamber. Provide basic trimmings for alarm test by pass, gages, drain connections, mounting supports for retarding chamber, and drip funnel. Provide pressure sensitive alarm switch to actuate the fire alarm system.

D. Drain Valves: Threaded bronze angle, globe, ball or butterfly, 4100 kPa (600 psi), Water or gas (WOG) equipped with reducer and hose connection with cap or connected to a drain line.

E. Self-contained Test and Drain Valve:

1. Ductile iron body with bronze "Drain" and "Test" bonnets. Acrylic sight glass for viewing test flow. Various sized orifice inserts to simulate flow through 14 mm (17/32 in.), 13 mm (1/2 in.), 12 mm

- (7/16 in.), and 10 mm (3/8 in.) diameter sprinklers, 32 mm (1 1/4 in.) female threaded outlets or 32 mm (1 1/4 in.) one-quarter turn locking lug outlets for plain end pipe (end preparation to be in accordance with manufacturer's recommendation).
2. Bronze body, with chrome plated bronze ball, brass stem, steel handle, Teflon seat and sight glasses. Provide valve with three position indicator plate (off, test, and drain), 6 mm (1/4 in.) tapping for pressure gage and various other orifice inserts to simulate flow through 10 mm (3/8 in.), 12 mm (7/16 in.), 13 mm (1/2 in.), and 14 mm (17/32 in.) diameter sprinklers.
- F. Dry Pipe Valve: Flanged, iron body. Provide basic trimmings for alarm test bypass, water flow alarm, high and low pressure switches, gages, drain connections, drip funnel, accelerator and necessary pipe, fittings and accessories required to provide a complete installation.
- G. Standpipe Hose Valve: 65 mm (2 1/2 in.) screwed, brass hose angle valve, 2400 kPa (350 psi) water working pressure, WWP, male hose threads same as local fire department service, 65 mm x 40 mm (2 1/2 in. x 1 1/2 in.) reducer, and with permanently attached polished brass cap and chain: Provide for valves installed in a cabinet a 65 mm (2 1/2 in.) attached cap and chain and a 65 mm x 40 mm (2 1/2 in. x 1 1/2 in.) reducer placed in cabinet.
- H. Standpipe hose valve cabinets: Cabinets shall be white glossy polyester coated 20 gage steel with continuous steel hinge with brass pin, recessed type 600 x 600 x 250 mm (24 x 24 x 10 in.).
- I. Double Check Backflow Prevention Assembly: Provide two independent check valves with OS&Y shut off valves, ball type test cocks. Maximum friction loss through assembly shall not exceed 35 kPa (5 psi) at design flow. Unit shall be functional in vertical or horizontal position, rated for 1200 kPa (175 psi) working pressure. Check valve assembly shall be in accordance with AWWA Class D. Double check backflow prevention assembly shall be FM approved, ASSE approved and UL listed.

2.4 AUTOMATIC BALL DRIPS

Cast brass 20 mm (3/4 in.) in line automatic ball drip with both ends threaded with iron pipe threads.

2.5 SPRINKLERS

- A. Quick response sprinklers shall be standard type except as noted below. The maximum distance from the deflector to finished ceiling shall be

50 mm (2 in.) for pendent sprinklers. Pendent sprinklers in finished areas shall be provided with semi-recessed adjustable screwed escutcheons and installed within the center one-third of their adjustment. The sprinkler shall be installed in the flush position with the element exposed below the ceiling line. At the specified locations, provide the following type of sprinklers. All sprinklers except "institutional" type sprinklers shall be FM approved. Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval, and the following:

LOCATION	TYPE
Mechanical Equipment Rooms, Electrical & Electrical Switch Gear Rooms	Quick Response, Upright or Telephone Closets, Transformer Vaults Pendent Brass [93 °C (200 °F)]
Elevator Shafts, Dumbwaiter Shafts, Elevator Machine Rooms, Elevator Pits	Standard Upright or Sidewall Brass [93 °C (200 °F)]
Gravity Type Linen & Trash Chutes	Standard Upright or Pendent Brass [66-74 °C (150-165 °F)]
Warehouse [Storage under 3600 mm (12 ft.)]	Quick Response, Pendent or Upright, Brass [77-74 °C (150- 165 °F)]
Warehouse [Storage over 3600 mm (12 ft.)]	See NFPA 13
Cold rooms, Freezers, Controlled Temperature Rooms and Unheated Areas	Standard Pendent, Dry Type [66- 74 °C (150-165 °F)]
Kitchen Hoods, Exhaust Ducts & Duct Collars	Standard Pendent or Upright (Extra High Temperature [163-191 °C (325- 375 °F.)])
Generator Rooms	Standard Pendent or Upright [141 °C (286 °F)]
Mental Health and Behavioral Unit: Nursing Bedroom, Toilets and all areas with plaster/ dry wall ceilings within the area	Institutional Quick Response; Chrome plated with 85 lb. breakaway, Pendent, Horizontal Sidewall [66-74 °C (150-165 °F)]
Patient Sleeping, Patient Bathrooms, and Corridors within a Patient Ward	Residential, Quick Response, Recessed Pendent, Chrome Plated, [66-74 °C (150-165 °F)]
All Patient Treatment, Elevator Lobbies and Corridors	Quick Response, Recessed Pendent, Chrome Plated [66-74 °C [150- 165 °F)]
Operating Rooms, Radiology Rooms, Nuclear Medicine Rooms	Quick Response, Recessed Pendent, Chrome Plated, Sidewall [66-74 °C (150-165 °F)]
All Areas Not Listed Above	Quick Response, Recessed Pendent, Sidewall, Chrome Plated [66-74 °C (150-165 °F)]

- B. Do not use quick response sprinklers in the same sprinkler zone with other sprinklers types. In sprinkled light hazard patient zones that are expanded into fully sprinkled zones, revise the existing system to contain quick response sprinklers.
- C. Sprinklers to be installed as per NFPA 13.

2.7 TOOLS AND REPLACEMENT PARTS**A. Sprinkler Cabinet:**

1. Provide a minimum 5 percent spare sprinklers with escutcheons with a minimum of two of each type/or as required by NFPA-13, whichever is more demanding.
2. Provide a minimum of two of each type sprinkler wrenches used.
3. Install cabinets in each building where directed by the Resident Engineer.
4. Spare sprinklers shall be kept in a cabinet where ambient temperatures do not exceed 100 Deg F.

B. Sprinkler system water flow switch: one of each size provided.**C. Sprinkler system valve tamper switch: one of each type provided.****D. Sprinkler system pressure switch: one of each type provided.****E. Provide two sprinkler plugs attached to multi-section extension poles 2400 mm (8 ft.) minimum.****2.08 IDENTIFICATION SIGNS**

Provide for all new and existing sectional valves, riser control valves, system control valves, drain valves, test and drain connections and alarm devices with securely attached identification signs (enamel on metal) in accordance with NFPA 13.

2.09 HANGERS AND EARTHQUAKE BRACING

In accordance with NFPA 13 and 14. Comply with seismic requirements as per 15050 for seismic zone locations.

2.10 WATERFLOW SWITCHES

- A. Integral, mechanical, non-coded, non-accumulative retard type, with two sets of SPDT auxiliary contacts and adjustable from 0 to 90 seconds. Set flow switches at an initial setting between 20 and 30 seconds.
- B. All conduit and wiring connected thereto shall be provided in Section 28 31 00, FIRE DETECTION AND ALARM.

2.11 VALVE SUPERVISORY SWITCHES

- A. Provide each indicating sprinkler, standpipe and fire pump control valve with adequate means for mounting a valve supervisory switch.
- B. Mount switch so as not to interfere with normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem is moved no more than one fifth of the distance from its normal position.

- C. The mechanism shall be contained in a weatherproof die cast aluminum housing, which shall provide a 20 mm (3/4 in.) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
- D. Switch housing to be finished in red baked enamel.
- E. Supervisory switches for ball and butterfly valves may be integral with the valve.
- F. All conduit and wiring connected thereto shall be provided in Section 28 31 00, FIRE DETECTION AND ALARM.

2.12 PRESSURE SWITCHES

- A. Provide with 15 mm (1/2 in.) NPT male pressure connection.
- B. Alarm switch shall be activated by any flow of water equal to or in excess of the discharge from one sprinkler.
- C. Supervisory switch shall be activated by either high or low air pressure condition.
- D. Furnish switch in a red baked enamel, weatherproof, oil resistant housing with tamper resistant screws.

2.13 WALL, FLOOR AND CEILING PLATES

- A. Exposed piping passing through walls, floors or ceilings shall be provided with chrome colored escutcheon plates.
- B. Comply with NFPA 101 Fire Barrier Penetration codes.

2.14 KITCHEN VENTILATOR HOOD FIRE PROTECTION

- A. Provide piping from the building sprinkler system to the stub-out point on the ventilator control cabinet.
- B. Water pressure at the control cabinet shall be a minimum of 276 kPa (40 psi), maximum 552 kPa (80 psi). Provide a pressure reducing valve if the water pressure exceeds 552 kPa (80 psi).
- C. Activation of the flow switch shall shut off the electrical equipment and initiate a local alarm and the fire alarm for the affected zone.

2.15 PRESSURE GAUGE

- A. Provide a 690 kPa (100 psi) pressure gauge at each flow alarm switch location, at the top of each sprinkler or standpipe riser, at each main drain connection, and on the suction and discharge of the fire pump.

2.16 HANGERS

- A. Hangers shall be designed to support five times the weight of the water filled pipe plus 250 Lb (114Kg) at each point of piping support.
- B. These points of support shall be adequate to support the system.
- C. The spacing between hangers shall not exceed the value given for the type of pipe as indicated in NFPA 13 tables.

- D. Hanger components shall be ferrous.
- E. Detailed calculations shall be submitted, when required by the reviewing Authority, showing stress developed in hangers, piping, fittings and safety factors allowed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Supervisory Switches: For each indicating sprinkler zone control valve, provide a supervisory switch that is connected to the fire alarm system. Standpipe hose valves and test and drain valves shall not be provided with supervisory switches.
- B. Waterflow Switches: For each sprinkler zone and where indicated on drawings, provide a waterflow switch. Install waterflow switch and adjacent valves in easily accessible locations.
- C. Sprinkler Zone: Each sprinkler zone shall coincide with each smoke zone.
- D. Piping connections:
 - 1. Sprinkler System Only: Start at flanged outlet within the building at exterior wall.
- E. Drains, Test Pipes and Accessories:
 - 1. Provide a drain at base of risers, drain connection on valved sections, and drains at other locations for complete drainage of the system. Provide valve in drain lines and connect to the central drain riser. Discharge riser outside over splash block, indirectly over standpipe drain connected to storm sewer, or as indicated. The main drain shall be capable of full discharge test without allowing water to flow onto the floor.
 - 2. Provide test pipes in accordance with NFPA 13. Test pipes shall be valved and piped to discharge through proper orifice as specified above for drains.
- F. Conceal all piping, except in pipe basements, stairwells and rooms without ceilings.
- H. Install new piping and sprinklers aligned with natural building and other sprinklers lines.
- I. Piping arrangement shall avoid contact with other piping and equipment and allow clear access to other equipment or devices requiring access or maintenance.

- J. Cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections, shall be affixed near to the pipe where the originated. They shall be displayed until final inspection and then removed.
- K. Firestopping shall comply with Section 07 84 00, FIRESTOPPING. All holes through stairways, smoke barrier walls, and fire walls shall be sealed on a daily basis.
- L. Provide hydraulic design information signage as required by NFPA 13.
- M. Install access doors in ceilings of rooms where above ceiling access is required.

3.2 TEST

- A. Automatic Sprinkler System: NFPA 13 and 25.

3.3 INSTRUCTIONS

Furnish the services of a competent instructor for not less than two four-hour periods for instructing personnel in the operation and maintenance of the fire pump and sprinkler system, on the dates requested by the COTR.

- - - END - - -

SECTION 21 13 13
WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Design, installation and testing shall be in accordance with NFPA 13 except for specified exceptions.
- B. The design and installation of a hydraulically calculated automatic wet system complete and ready for operation, for all renovated portions of Building B108, including the, mechanical equipment rooms, attic space, telephone rooms.
- D. Modification of the existing sprinkler system as indicated on the drawings and as further required by these specifications.

1.2 RELATED WORK

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Section 07 84 00, FIRESTOPPING, Treatment of penetrations through rated enclosures.
- C. Section 09 91 00, PAINTING.
- D. Section 21 10 00, WATER-BASED FIRE-SUPPRESSION SYSTEMS, Dry sprinklers, fire pumps, etc.
- E. Section 28 31 00, FIRE DETECTION AND ALARM, Connection to fire alarm of flow switches, pressure switches and valve supervisory switches.
- F. Section 21 05 11 COMMON WORK RESULTS FOR FIRE SUPPRESSION

1.3 QUALITY ASSURANCE

- A. Installer Reliability: The installer shall possess a valid State of Texas fire sprinkler contractor's license. The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.
- B. Materials and Equipment: All equipment and devices shall be of a make and type listed by UL and approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the VA.
- C. Submittals: Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering. As Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction

that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide index referencing the appropriate specification section. Submittals shall include, but not be limited to, the following:

1. Qualifications:
 - a. Provide a copy of the installing contractors fire sprinkler contractors license.
 - b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering.
2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to NFPA 13. Include a site plan showing the piping to the water supply test location.
3. Manufacturers Data Sheets:
 - a. For backflow preventers, provide flow test curves from UL, FM, or the Foundation for Hydraulic Research and Cross-Connection Control to verify pressure loss calculations.
 - b. Provide for materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.
4. Calculation Sheets: Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of NFPA 13.
5. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submittals shall include, but not be limited to, the following:
 - a. One complete set of reproducible as-built drawings showing the installed system with the specific interconnections between the waterflow switch or pressure switch and the fire alarm equipment.
 - b. Complete, simple, understandable, step-by-step, testing instructions giving recommended and required testing frequency of all equipment, methods for testing all equipment, and a complete trouble shooting manual. Provide maintenance instructions on replacing any components of the system including internal parts, periodic cleaning and adjustment of the equipment and components

- with information as to the address and telephone number of both the manufacturer and the local supplier of each item.
- c. Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA 13.
 - d. Certificates shall document all parts of the installation.
 - e. Instruction Manual: Provide one copy of the instruction manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser.
- D. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13. Recommendations in appendices shall be treated as requirements.
- 1. Perform hydraulic calculations in accordance with NFPA 13 utilizing the Area/Density method. Do not restrict design area reductions permitted for using quick response sprinklers throughout by the required use of standard response sprinklers in the areas identified in this section.
 - 2. Sprinkler Protection: To determining spacing and sizing, apply the following coverage classifications:
 - a. Light Hazard Occupancies: Patient care, treatment, and customary access areas.
 - b. Ordinary Hazard Group 1 Occupancies: Laboratories, Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Repair Shops.
 - c. Ordinary Hazard Group 2 Occupancies: Storage rooms, trash rooms, clean and soiled linen rooms, pharmacy and associated storage, laundry, kitchens, kitchen storage areas, retail stores, retail store storage rooms, storage areas, building management storage, boiler plants, energy centers, warehouse spaces, file storage areas for the entire area of the space up to 140 square meters (1500 square feet) and Supply Processing and Distribution (SPD).
 - d. Request clarification from the Government for any hazard classification not identified.
 - 3. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.
 - 4. Water Supply: Base water supply on a flow test of:
 - a. Location _____

- b. Elevation Static Test Gauge _____ m
(_____ ft)
- c. Elevation Residual Test Gauge _____ m
(_____ ft)
- d. Static pressure: _____ kPa (_____ psi)
- e. Residual pressure: _____ kPa (_____ psi)
- f. Flow: _____ L/s (_____ gpm)
- g. Date: _____ Time _____
- 5. Zoning:
 - a. For each sprinkler zone provide a control valve, flow switch and a test and drain assembly with pressure gauge.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA, latest edition):
 - 13-.....Installation of Sprinkler Systems
 - 101-.....Safety to Life from Fire in Buildings and Structures (Life Safety Code)
 - 170-.....Fire Safety Symbols
- C. Underwriters Laboratories, Inc. (UL):
 - Fire Protection Equipment Directory - 2010
- D. Factory Mutual Engineering Corporation (FM):
 - Approval Guide - 2010
- E. Uniform Building Code - 2006
- F. Foundation for Cross-Connection Control and Hydraulic Research-2005

PART 2 PRODUCTS

2.1 PIPING & FITTINGS

- A. Sprinkler systems in accordance with NFPA 13. Use nonferrous piping in MRI Scanning Rooms. Flexible pipe connections to sprinkler heads are not permitted. All connections shall be hard piped.

2.2 VALVES

- A. Valves in accordance with NFPA 13.
- B. Do not use quarter turn ball valves for 50 mm (2 inch) or larger drain valves.
- C. The wet system control valve shall be a listed indicating type valve. Control valve shall be UL Listed and FM Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI. (No Substitutions Allowed).

- D. Alarm valve shall be UL Listed and Factory Mutual Approved. The alarm valve shall be equipped with a removable cover assembly. The alarm valve shall be listed for installation in the vertical or horizontal position. The alarm valve shall be equipped with gauge connections on the system side and supply side of the valve clapper. The alarm valve shall be equipped with an external bypass to eliminate false water flow alarms. The alarm valve trim piping shall be externally galvanized. Maximum water working pressure to 250 PSI.
- G. Automatic Ball Drips: Cast brass 20 mm (3/4 inch) in-line automatic ball drip with both ends threaded with iron pipe threads.

2.3 SPRINKLERS

- A. All sprinklers except "institutional" type sprinklers shall be FM approved. Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval.
 - 1. Cold storage rooms: Standard response dry pendant sprinklers.
- B. Temperature Ratings: In accordance with NFPA 13,.

2.5 SPRINKLER CABINET

Provide sprinkler cabinet with the required number of sprinkler heads of all ratings and types installed, and a sprinkler wrench for each system. Locate adjacent to the riser. Sprinkler heads shall be installed in center of tile or center to center.

2.6 IDENTIFICATION SIGNS/HYDRAULIC PLACARDS

Plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Enter pertinent data for each system on the hydraulic placard.

2.7 SWITCHES:

- A. Contain in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 13 mm (1/2 inch) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.
- B. Water flow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.
- C. Pressure Switches: Activation by any flow of water equal to or in excess of the discharge from one sprinkler. Water Flow Indicating Pressure Switch will activate an alarm by way of an alarm pressure switch. The alarm pressure switch shall be compatible with system devices. The alarm pressure enclosure shall be UL Listed and Factory Mutual Approved for the application in which it is used. The alarm pressure switch shall have the ability to be wired for Class A or Class B service.

- D. Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.

2.8 GAUGES

Provide gauges as required by NFPA 13.

2.9 PIPE HANGERS AND SUPPORTS

Supports, hangers, etc., of an approved pattern placement to conform to NFPA 13. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to the requirements set forth in NFPA 13, Standard for Installation of Sprinkler Systems. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application. Hangers or supports not specifically listed for service shall be designed and bear the seal of a professional engineer.

2.11 WALL, FLOOR AND CEILING PLATES

Provide chrome plated steel escutcheon plates for exposed piping passing through walls, floors or ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Install concealed piping in spaces that have finished ceilings. Where ceiling mounted equipment exists, such as in operating and radiology rooms, install sprinklers so as not to obstruct the movement or operation of the equipment. Sidewall heads may need to be utilized. Locate piping in stairways as near to the ceiling as possible to prevent tampering by unauthorized personnel, and to provide a minimum headroom clearance of 2250 mm (seven feet six inches). To prevent an obstruction to egress, provide piping clearances in accordance with NFPA 101.
- C. Welding: Conform to the requirements and recommendations of NFPA 13.
- D. Drains: Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13.

- E. Supervisory Switches: Provide supervisory switches for sprinkler control valves.
- F. Waterflow Alarm Switches: Install waterflow switch and adjacent valves in easily accessible locations.
- G. Inspector's Test Connection: Install and supply in conformance with NFPA 13, locate in a secured area, and discharge to the exterior of the building.
- H. Kitchen Ventilator Hood Fire Protection: Provide piping from the building sprinkler system to the stub-out point on the ventilator control cabinet. Size piping in accordance with manufacturer specifications.
- I. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.
- J. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material in accordance with Section 07 84 00, FIRESTOPPING. Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction, in accordance with Section 07 84 00, FIRESTOPPING.
- K. Provide pressure gauge at each water flow alarm switch location and at each main drain connection.
- L. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.
- N. The drain piping shall not be restricted or reduced and shall be of the same diameter as the drain collector.
- O. Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch.
- P. Repairs: Repair damage to the building or equipment resulting from the installation of the sprinkler system by the installer at no additional expense to the Government.
- Q. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the Contracting Officer. Contractor shall develop an interim fire protection program where interruptions involve in occupied spaces. Request in writing at least one week prior to the planned interruption.

3.2 INSPECTION AND TEST

- A. Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA 13, in the presence of the Contracting Officers Technical Representative (COTR) or his designated representative. Test and flush underground water line prior to performing these hydrostatic tests.
- B. Final Inspection and Testing: Subject system to tests in accordance with NFPA 13, and when all necessary corrections have been accomplished, advise COTR/Resident Engineer to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test.

3.3 INSTRUCTIONS

Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the COTR/Resident Engineer.

- - - E N D - - -

SECTION 22 05 11
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section shall apply to all sections of Division 22.
- B. Definitions:
 - 1. Exposed: Piping and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
- D. Section 31 20 00, EARTH MOVING: Excavation and Backfill.
- E. Section 05 31 00, Building Components for Attachment of Hangers.
- F. Section 05 50 00, METAL FABRICATIONS.
- G. Section 07 84 00, FIRESTOPPING.
- H. Section 07 60 00, FLASHING AND SHEET METAL: Flashing for Wall and Roof Penetrations.
- H. Section 07 92 00, JOINT SEALANTS.
- J. Section 09 91 00, PAINTING.
- K. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS
- L. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT .

1.3 QUALITY ASSURANCE

- A. Products Criteria:
 - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years.
 - 2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These

- organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, critical instrumentation, computer workstation and programming shall be submitted for project record and inserted into the operations and maintenance manual.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
 4. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Resident Engineer (RE)/Contracting Officers Technical Representative (COTR).
 5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
 6. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
 8. Asbestos products or equipment or materials containing asbestos shall not be used.
- B. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".

2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
 3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
 4. All welds shall be stamped according to the provisions of the American Welding Society.
- C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- D. Execution (Installation, Construction) Quality:
1. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract drawings and specifications shall be referred to the RE/COTR for resolution. Written hard copies or computer files of manufacturer's installation instructions shall be provided to the RE/COTR at least two weeks prior to commencing installation of any item.
 2. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved.
- E. Guaranty: Warranty of Construction, FAR clause 52.246-21.
- F. Plumbing Systems: IPC, International Plumbing Code.

1.4 SUBMITTALS

- A. Submittals shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.
- C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems.

Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

- E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- F. Upon request by Government, lists of previous installations for selected items of equipment shall be provided. Contact persons who will serve as references, with telephone numbers and e-mail addresses shall be submitted with the references.
- G. Manufacturer's Literature and Data: Manufacturer's literature shall be submitted under the pertinent section rather than under this section.
 - 1. Electric motor data and variable speed drive data shall be submitted with the driven equipment.
 - 2. Equipment and materials identification.
 - 3. Fire stopping materials.
 - 4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
 - 5. Wall, floor, and ceiling plates.
- H. Coordination Drawings: Complete consolidated and coordinated layout drawings shall be submitted for all new systems, and for existing systems that are in the same areas. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show the proposed location and adequate clearance for all equipment, piping, pumps, valves and other items. All valves, trap primer valves, water hammer arrestors, strainers, and equipment requiring service shall be provided with an access door sized for the complete removal of plumbing device, component, or equipment. Equipment foundations shall not be installed until equipment or piping until layout drawings have been approved. Detailed layout drawings shall be provided for all piping systems. In addition, details of the following shall be provided.
 - 1. Mechanical equipment rooms.
 - 2. Interstitial space.

3. Hangers, inserts, supports, and bracing.
4. Pipe sleeves.
5. Equipment penetrations of floors, walls, ceilings, or roofs.

I. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided.
3. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Damaged equipment shall be replaced with an identical unit as determined and directed by the RE/COTR. Such replacement shall be at no additional cost to the Government.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Government. All piping shall be tested in accordance with the specifications and the International Plumbing

Code (IPC), latest edition. All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.

4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below shall form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code (BPVC):
SEC IX-2007.....Boiler and Pressure Vessel Code; Section IX,
Welding and Brazing Qualifications.
- C. American Society for Testing and Materials (ASTM):
A36/A36M-2008.....Standard Specification for Carbon Structural
Steel
A575-96 (R 2007).....Standard Specification for Steel Bars, Carbon,
Merchant Quality, M-Grades R (2002)
E84-2005.....Standard Test Method for Surface Burning
Characteristics of Building Materials
E119-2008a.....Standard Test Methods for Fire Tests of
Building Construction and Materials
- D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
SP-58-02.....Pipe Hangers and Supports-Materials, Design and
Manufacture
SP 69-2003 (R 2004).....Pipe Hangers and Supports-Selection and
Application
- E. National Electrical Manufacturers Association (NEMA):
MG1-2003, Rev. 1-2007...Motors and Generators
- E. International Code Council, (ICC):
IBC-06, (R 2007).....International Building Code
IPC-06, (R 2007).....International Plumbing Code

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

- A. STANDARDIZATION OF COMPONENTS SHALL BE MAXIMIZED TO REDUCE SPARE PART requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
 2. Constituent parts that are alike shall be products of a single manufacturer.
 3. Components shall be compatible with each other and with the total assembly for intended service.
 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, shall be the same make and model

2.2 COMPATIBILITY OF RELATED EQUIPMENT

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 SAFETY GUARDS

- A. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 6 mm (1/4-inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.
- B. All Equipment shall have moving parts protected from personal injury.

2.4 LIFTING ATTACHMENTS

Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.5 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

- A. All material and equipment furnished and installation methods shall conform to the requirements of Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT; Section 26 29 11, LOW-VOLTAGE

MOTOR STARTERS; and, Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems shall be provided. Premium efficient motors shall be provided. Unless otherwise specified for a particular application, electric motors shall have the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the Government.
2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
 - a. Wiring material located where temperatures can exceed 71° C (160° F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
 - b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
 - c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems shall be provided where recommended by manufacturer of equipment.
4. Motor sizes shall be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated "inverter-ready" per NEMA Standard, MG1, Part 31.4.4.2.

C. Motor Efficiency and Power Factor: All motors, when specified as "high efficiency or Premium Efficiency" by the project specifications on driven equipment, shall conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as "NEMA premium efficient" and the requirements generally exceed those of

the Energy Policy Act of 1992 (EPACT). Motors not specified as "high efficiency or premium efficient" shall comply with EPACT.

- D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).
- E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. A time delay (20 seconds minimum) relay shall be provided for switching from high to low speed.
- F. Rating: Rating shall be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation shall not exceed nameplate rating without service factor.
- G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame shall be measured at the time of final inspection.

2.6 VARIABLE SPEED MOTOR CONTROLLERS

- A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS for specifications.
- B. The combination of controller and motor shall be provided by the respective pump manufacturer, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. pumps, shall be product of a single manufacturer.
- C. Motors shall be premium efficient type, "invertor duty", and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.
- D. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.

2.7 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.

- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, fans, etc. shall be identified.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.
- D. Control Items: All temperature, pressure, and controllers shall be labeled and the component's function identified. Identify and label each item as they appear on the control diagrams.
- E. Valve Tags and Lists:
 - 1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (Fixture stops not included).
 - 2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage, 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
 - 3. Valve lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. A copy of the valve list shall be mounted in picture frames for mounting to a wall.
 - 4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling.

2.8 FIRE STOPPING

- A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, for pipe insulation.

2.9 GALVANIZED REPAIR COMPOUND

- A. Mil. Spec. DOD-P-21035B, paint.

2.10 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC), latest edition, and SECTION 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Submittals based on the International Building Code (IBC), latest edition, SECTION 13 05 41 requirements, or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in a state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the Resident Engineer in all cases. See these specifications for lateral force design requirements.
- B. Type Numbers Specified: MSS SP-58. For selection and application refer to MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.
- C. For Attachment to Concrete Construction:
 - 1. Concrete insert: Type 18, MSS SP-58.
 - 2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (4 inches) thick when approved by the Resident Engineer for each job condition.
 - 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (4 inches) thick when approved by the Resident Engineer for each job condition.
- D. For Attachment to Steel Construction: MSS SP-58.
 - 1. Welded attachment: Type 22.
 - 2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8-inch) outside diameter.
- E. Attachment to Metal Pan or Deck: As required for materials specified in Section 05 31 00, STEEL DECKING. For Attachment to Wood Construction: Wood screws or lag bolts.
- G. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- H. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special

spring held, hardened steel nuts. Trapeze hangers are not permitted for steam supply and condensate piping.

1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13 mm (1/2-inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

I. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.

1. General Types (MSS SP-58):

- a. Standard clevis hanger: Type 1; provide locknut.
- b. Riser clamps: Type 8.
- c. Wall brackets: Types 31, 32 or 33.
- d. Roller supports: Type 41, 43, 44 and 46.
- e. Saddle support: Type 36, 37 or 38.
- f. Turnbuckle: Types 13 or 15.
- g. U-bolt clamp: Type 24.
- h. Copper Tube:

- 1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with isolation tape to prevent electrolysis.
- 2) For vertical runs use epoxy painted or plastic coated riser clamps.
- 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
- 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

2. Plumbing Piping (Other Than General Types):

- a. Horizontal piping: Type 1, 5, 7, 9, and 10.
- b. Chrome plated piping: Chrome plated supports.

- c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
- d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.

2.11 PIPE PENETRATIONS

- A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
- B. Pipe penetration sleeve materials shall comply with all fire stopping requirements for each penetration.
- C. To prevent accidental liquid spills from passing to a lower level, provide the following:
 - 1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
 - 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
 - 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Resident Engineer.
- D. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.
- F. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel Sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.

- G. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.
- H. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- I. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.12 TOOLS AND LUBRICANTS

- A. Furnish, and turn over to the Resident Engineer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.13 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3 inch) pipe, 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

2.14 ASBESTOS

Materials containing asbestos are not permitted.

PART 3 - EXECUTION**3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING**

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.

Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.

C. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:

1. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by RE/COTR where working area space is limited.

2. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by RE/COTR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to RE/COTR for approval.

3. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.

- F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- H. Protection and Cleaning:
 - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
 - 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. shall be used for all pad or floor mounted equipment. Gages, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gages shall be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- J. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.
- K. Many plumbing systems interface with the HVAC control system. See the HVAC control points list and section 23 09 23 DIRECT DIGITAL CONTROLS FOR HVAC
- L. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
 2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.
- M. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.
- N. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.
- O. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- P. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

- A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.
- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Para. 3.1 shall apply.

- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

3.3 RIGGING

- A. Openings in building structures shall be planned to accommodate design scheme.
- B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.
- C. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.
- D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.
- E. Contractor shall check all clearances, weight limitations and shall provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- F. Rigging plan and methods shall be referred to RE/COTR for evaluation prior to actual work.

3.4 PIPE AND EQUIPMENT SUPPORTS

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes shall be drilled or burned in structural steel ONLY with the prior written approval of the Resident Engineer.
- B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.
- C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work shall be provided.

D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC), latest edition, and these specifications.

E. Overhead Supports:

1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems shall be supported in channel troughs.

F. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.
4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LUBRICATION

- A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.
- B. All devices and equipment shall be equipped with required lubrication fittings. A minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be delivered to RE/COTR in unopened containers that are properly identified as to application.

- C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.
- D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.
- E. All lubrication points shall be extended to one side of the equipment.

3.6 PLUMBING SYSTEMS DEMOLITION

- A. Rigging access, other than indicated on the drawings, shall be provided after approval for structural integrity by the RE/COTR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris shall be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.
- B. In an operating plant, cleanliness and safety shall be maintained. The plant shall be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in accordance with recognized fire protection standards. Inspections will be made by personnel of the VA Medical Center, and the Contractor shall follow all directives of the RE or COTR with regard to rigging, safety, fire safety, and maintenance of operations.
- C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

- D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to RE/COTR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

3.7 CLEANING AND PAINTING

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.
- B. In addition, the following special conditions apply:
1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.
 2. The following Material And Equipment shall NOT be painted::
 - a. Motors, controllers, control switches, and safety switches.
 - b. Control and interlock devices.
 - c. Regulators.
 - d. Pressure reducing valves.
 - e. Control valves and thermostatic elements.
 - f. Lubrication devices and grease fittings.
 - g. Copper, brass, aluminum, stainless steel and bronze surfaces.
 - h. Valve stems and rotating shafts.
 - i. Pressure gages and thermometers.
 - j. Glass.
 - k. Name plates.
 3. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall be made with matching paint obtained from manufacturer or computer matched.
 4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
 5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.

6. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this.

3.8 IDENTIFICATION SIGNS

- A. Laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.
- B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance shall be placed on factory built equipment.
- C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.9 STARTUP AND TEMPORARY OPERATION

- A. Start up of equipment shall be performed as described in the equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.10 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, all required tests shall be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests such systems respectively during first actual seasonal use of respective systems following completion of work.

3.11 OPERATION AND MAINTENANCE MANUALS

- A. Provide four bound copies. The Operations and maintenance manuals shall be delivered to RE/COTR not less than 30 days prior to completion of a phase or final inspection.

- B. All new and temporary equipment and all elements of each assembly shall be included.
- C. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.
- D. Manufacturer's installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.
- E. Lubrication instructions, type and quantity of lubricant shall be included.
- F. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.
- G. Set points of all interlock devices shall be listed.
- H. Trouble-shooting guide for the control system troubleshooting guide shall be inserted into the Operations and Maintenance Manual.
- I. The combustion control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.
- J. Emergency procedures.

3.12 INSTRUCTIONS TO VA PERSONNEL

Instructions shall be provided in accordance with Article,
INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the requirements for general-duty valves for domestic water and sewer systems.

1.2 RELATED WORK

- A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
1. Valves.
 2. Backflow Preventers.
 3. Pressure Reducing Valves.
 4. Backwater Valves
 5. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM): A536-84 (R 2004)
Standard Specification for Ductile Iron Castings
- C. American Society of Sanitary Engineering (ASSE)
ASSE 1003-01 (R 2003)...Performance Requirements for Water Pressure Reducing Valves
ASSE 1012-02.....Backflow Preventer with Intermediate Atmospheric Vent
ASSE 1013-05.....Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
- D. International Code Council (ICC)
IPC-06 (R 2007).....International Plumbing Code
- E. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
SP-25-98.....Standard Marking System for Valves, Fittings, Flanges and Unions
SP-67-02a (R 2004) Butterfly Valve of the Single flange Type (Lug Wafer)

SP-70-06.....Cast Iron Gate Valves, Flanged and Threaded
Ends.

SP-72-99.....Ball Valves With Flanged or Butt Welding For
General Purpose

SP-80-03.....Bronze Gate, Globe, Angle and Check Valves.

SP-110-96.....Ball Valve Threaded, Socket Welding, Solder
Joint, Grooved and Flared Ends

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Valves shall be prepared for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Valves shall be prepared for storage as follows:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature.
- C. A sling shall be used for large valves. The sling shall be rigged to avoid damage to exposed parts. Hand wheels or stems shall not be used as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES

- A. Asbestos packing and gaskets are prohibited.
- B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc shall not be permitted.
- C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.
- D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 meters (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.

E. Ball valves, pressure regulating valves, gate valves, globe valves, and plug valves used to supply potable water shall meet the requirements of NSF 61.

F. Shut-off:

1. Cold, Hot and Re-circulating Hot Water:

a. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-72, SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4140 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be solder,

b. Less than 100 mm DN100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A 536, ductile iron.

c. 100 mm (DN100) (4 inches) and larger:

1) Class 125, OS&Y, Cast Iron Gate Valve. The gate valve shall meet MSS-SP-70 type I standard. The gate valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall meet ASTM A 126, grey iron with bolted bonnet, flanged ends, bronze trim, and solid wedge disc. The gate valve shall be gear operated for sizes under 200 mms or DN200 (8 inches) and crank operated for sizes 200 mms or DN200 (8 inches) and above

2) Single flange, ductile iron butterfly valves: The single flanged butterfly valve shall meet the MSS SP-67 standard. The butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The butterfly valve shall be lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange. The body material shall comply with ASTM A536 ductile iron. The seat shall be EPDM with stainless steel disc and stem.

3) Grooved end, ductile iron butterfly valves. The grooved butterfly valve shall meet the MSS SP-67 standard. The grooved butterfly valve shall have a CWP rating of 1380 kPa

(200 psig). The valve materials shall be polyamide coated ductile iron conforming to ASTM A536 with two piece stainless steel stem, EPDM encapsulated ductile iron disc, and EPDM seal. The butterfly valve shall be gear operated

C. Balancing:

1. Hot Water Re-circulating, 80 mm or DN80 (3 inches) and smaller manual balancing valve shall be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve shall have differential pressure read-out ports across the valve seat area. The read out ports shall be fitting with internal EPT inserts and check valves. The valve body shall have 8 mm or DN8 NPT (¼" NPT) tapped drain and purge port. The valves shall have memory stops that allow the valve to close for service and then reopened to set point without disturbing the balance position. All valves shall have calibrated nameplates to assure specific valve settings.
2. Larger than 80 mm or DN80 (3 inches): Manual balancing valves shall be of heavy duty cast iron flanged construction with 862 kPa (125 psi) flange connections. The flanged manual balancing valves shall have either a brass ball with glass and carbon filled TFE seal rings or fitted with a bronze seat, replaceable bronze disc with EPDM seal insert and stainless steel stem. The design pressure shall be 1207 kPa (175) at 121 deg C (250 deg F).

D. Check:

1. Check valves less than 80 mm or DN80 (3 inches) and smaller) shall be class 125, bronze swing check valves with non metallic Buna-N disc. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B 62, solder joints, and PTFE or TFE disc.
2. Larger than 100 mm or DN100 (4 inches and larger):
 - a. Check valves shall be class 125, iron swing check valve with lever and weight closure control. The check valve shall meet MSS SP-71 Type I standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a clear or full waterway body design with gray iron body material conforming to ASTM A 126, bolted bonnet, flanged ends, bronze trim.

- b. All check valves on the discharge side of submersible sump pumps shall have factory installed exterior level and weight with sufficient weight to prevent the check valve from hammering against the seat when the sump pump stops.

E. Globe:

1. 80 mm or DN80 (3 inches) or smaller: Class 150, bronze globe valve with non metallic disc. The globe valve shall meet MSS SP-80, Type 2 standard. The globe valve shall have a CWP rating of 2070 kPa (300 psig). The valve material shall be bronze with integral seal and union ring bonnet conforming to ASTM B 62 with solder ends, copper-silicon bronze stem, TPF E or TFE disc, malleable iron hand wheel.
2. Larger than 80 mm or DN80 (3 inches): Similar to above, except with cast iron body and bronze trim, class 125, iron globe valve. The globe valve shall meet MSS SP-85, Type 1 standard. The globe valve shall have a CWP rating of 1380 kPa (200 psig). The valve material shall be gray iron with bolted bonnet conforming to ASTM A 126 with flanged ends, bronze trim, malleable iron handwheel.

2.2 WATER PRESSURE REDUCING VALVE AND CONNECTIONS

- A. 80 mm or DN80 (3 inches) or smaller: The pressure reducing valve shall consist of a bronze body and bell housing, a separate access cover for the plunger, and a bolt to adjust the downstream pressure. The bronze bell housing and access cap shall be threaded to the body and shall not require the use of ferrous screws. The assembly shall be of the balanced piston design and shall reduce pressure in both flow and no flow conditions. The assembly shall be accessible for maintenance without having to remove the body from the line.
- B. 100 mm or DN100 (4 inches) and larger: The pressure reducing valve shall consist of a flanged cast iron body and rated to 1378-kPa (200-psig). The valve shall have a large Hycar diaphragm for sensitive response.
- C. The regulator shall have a tap for pressure gauge.
- D. The regulator shall have a temperature rating of 100° C (210° F) for hot water or hot water return service. Pressure regulators shall have accurate pressure regulation to 6.9-kPa (+/- 1 psig).
- C. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.

- D. Connections Valves and Strainers: shut off valves shall be installed on each side of reducing valve and a bypass line equal in size to the regulator inlet pipe shall be installed with a normally closed globe valve. A strainer shall be installed on inlet side of, and same size as pressure reducing valve. A pressure gage shall be installed on the low pressure side of the line.

2.3 BACKWATER VALVE

- A. The backwater valve shall have a cast iron body, automatic type ABS valve seat and flapper which are slightly open during periods of non operation. The cleanout shall be extended to the finish floor and fit with a threaded countersunk plug. A clamping device shall be included when the cleanout extends through the waterproofing membrane.
- B. When the backwater valve is installed greater than 600 mm (24 inches) below the finish floor elevation, a pit or manhole large enough for a repair person can enter to service the backwater valve shall be installed.

2.4 BACKFLOW PREVENTERS

- A. A backflow prevention assembly shall be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly shall be ASSE 1013 listed and certified.
- B. Reduced pressure backflow preventers shall be installed in the following applications.
1. Deionizers.
 2. Sterilizers.
 3. Stills.
 4. Dialysis, Deionized or Reverse Osmosis Water Systems.
 5. Water make up to heating systems, cooling tower, chilled water system, generators, and similar equipment consuming water.
 6. Water service entrance from loop system.
 7. Dental Equipment
 8. Power washer
 9. Atmospheric Vacuum Breaker: ASSE 1001
 - a. Hose bibs and sinks w/threaded outlets.
 - b. Disposers.
 - c. Showers (telephone type).
 - d. Hydrotherapy units.
 - e. Autopsy, on each hot and cold water outlet at each table or sink.

- f. All kitchen equipment, if not protected by air gap.
 - g. Ventilating hoods with wash down system.
 - h. Film processor.
 - i. Detergent system
 - j. Dental equipment
 - k. Fume hoods
 - l. Glassware washers
- C. The reduced pressure principle backflow prevention assembly shall be ASSE listed 1013 with full port OS&Y gate valves and an integral relief monitor switch. The main body and access cover shall be epoxy coated duct iron conforming to ASTM A536 grade 4. The seat ring and check valve shall be Noryl (NSF listed). The stem shall be stainless steel conforming to ASTM A276. The seat disc elastomer shall be EPDM. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. An epoxy coated wye type strainer with flanged connections shall be installed on the inlet.
- D. The atmospheric vacuum breaker shall be ASSE listed 1001. The main body shall be either cast bronze. All internal polymers shall be NSF listed. The seat disc elastomer shall be silicone. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable.
- E. The double check detector backflow prevention assembly shall be ASSE listed 1048 and supply with full port OS&Y gate valves. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade. The seat ring and check valve shall be Noryl (NSF listed). The stem shall be stainless steel conforming to ASTM A 276. The seat disc elastomers shall be EPDM. The first and second check valve shall be accessible for maintenance without removing the device from the line.

2.5 CHAINWHEELS

- A. Valve chain wheel assembly with sprocket rim brackets and chain shall be constructed according to the following:
- 1. Brackets: type, number, size, and fasteners required to mount actuator on valve.
 - 2. Attachment: For connection to valve stem.

3. Chain: hot dipped galvanized steel of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.
- B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.
- C. Threads on valve and mating pipe shall be examined for form and cleanliness.
- D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.
- C. Valves shall be installed in horizontal piping with stem at or above center of pipe
- D. Valves shall be installed in a position to allow full stem movement.
- E. Install chain wheels on operators for [ball] [butterfly] [gate] and [globe] valves NPS 100 mm or DN100 (4 inches) and larger and more than [2400 mm (12 feet) above floor. Chains shall be extended to 1500 mm 3600 mm (60 inches) above finished floor.
- F. Check valves shall be installed for proper direction of flow and as follows:
 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

- A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves shall be replaced if persistent leaking occurs.

- - E N D - - -

SECTION 22 07 11
PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field applied insulation for thermal efficiency and condensation control for
 - 1. Plumbing piping and equipment.
 - 2. Re-insulation of plumbing piping and equipment after asbestos abatement.
- B. Definitions
 - 1. ASJ: All service jacket, white finish facing or jacket.
 - 2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
 - 3. Cold: Equipment or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
 - 4. Concealed: Piping above ceilings and in chases, interstitial spaces, and pipe chases.
 - 5. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
 - 6. FSK: Foil-scrim-kraft facing.
 - 7. Hot: Plumbing equipment or piping handling media above 41 degrees C (105 degrees F).
 - 8. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
 - 9. Thermal conductance: Heat flow rate through materials.
 - a. Flat surface: Watts per square meter (BTU per hour per square foot).
 - b. Pipe or Cylinder: Watts per square meter (BTU per hour per linear foot).
 - 10. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
 - 11. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of

this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.

- 12. R: Pump recirculation.
- 13. CW: Cold water.
- 14. SW: Soft water.
- 15. HW: Hot water.
- 16. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

- A. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT: Insulation containing asbestos material.
- B. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.
- F. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.
- E. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS. Requirements for commissioning, systems readiness checklists, and training.

1.3 QUALITY ASSURANCE

- A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

- B. Criteria:

- 1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

4.3.3.1 Pipe insulation and coverings, vapor retarder facings, adhesives, fasteners, tapes, unless otherwise provided for in 4.3.3.1.12 or 4.3.3.1.2, shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.

4.3.3.1.1 Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

4.3.3.3 Pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test

for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).

4.3.10.2.6.3 Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.10.2.6.7 Smoke detectors shall not be required to meet the provisions of this section.

2. Test methods: ASTM E84, UL 723, or NFPA 255.

3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.

4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.

a. Insulation materials: Specify each type used and state surface burning characteristics.

b. Insulation facings and jackets: Each type used.

c. Insulation accessory materials: Each type used.

- d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
- e. Make reference to applicable specification paragraph numbers for coordination.

1.5 STORAGE AND HANDLING OF MATERIAL

Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
 L-P-535E (2)-91.....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.
- C. Military Specifications (Mil. Spec.):
 MIL-A-3316C (2)-90.....Adhesives, Fire-Resistant, Thermal Insulation
 MIL-A-24179A (1)-87.....Adhesive, Flexible Unicellular-Plastic Thermal Insulation
 MIL-C-19565C (1)-88.....Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
 MIL-C-20079H-87.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass
- D. American Society for Testing and Materials (ASTM):
 A167-04Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 B209-07.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 C411-05.....Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation
 C449-07.....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

- C533-09.....Standard Specification for Calcium Silicate
Block and Pipe Thermal Insulation
- C534-08Standard Specification for Preformed Flexible
Elastomeric Cellular Thermal Insulation in
Sheet and Tubular Form
- C547-07Standard Specification for Mineral Fiber pipe
Insulation
- C552-07Standard Specification for Cellular Glass
Thermal Insulation
- C553-08Standard Specification for Mineral Fiber
Blanket Thermal Insulation for Commercial and
Industrial Applications
- C585-09.....Standard Practice for Inner and Outer Diameters
of Rigid Thermal Insulation for Nominal Sizes
of Pipe and Tubing (NPS System) R (1998)
- C612-10Standard Specification for Mineral Fiber Block
and Board Thermal Insulation
- C1126-10.....Standard Specification for Faced or Unfaced
Rigid Cellular Phenolic Thermal Insulation
- C1136-10Standard Specification for Flexible, Low
Permeance Vapor Retarders for Thermal
Insulation
- D1668-97a (2006).....Standard Specification for Glass Fabrics (Woven
and Treated) for Roofing and Waterproofing
- E84-10Standard Test Method for Surface Burning
Characteristics of Building
Materials
- E119-09C.....Standard Test Method for Fire Tests of Building
Construction and Materials
- E136-09 b.....Standard Test Methods for Behavior of Materials
in a Vertical Tube Furnace at 750 degrees C
(1380 F)
- E. National Fire Protection Association (NFPA):
- 101-09Life Safety Code
- 251-06.....Standard methods of Tests of Fire Endurance of
Building Construction Materials
- 255-06.....Standard Method of tests of Surface Burning
Characteristics of Building Materials

F. Underwriters Laboratories, Inc (UL):

723.....UL Standard for Safety Test for Surface Burning
Characteristics of Building Materials with
Revision of 08/03

G. Manufacturer's Standardization Society of the Valve and Fitting
Industry (MSS):

SP58-2002.....Pipe Hangers and Supports Materials, Design,
and Manufacture

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

- A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m³ (3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).
- B. ASTM C553 (Blanket, Flexible) Type I, Class B-5, Density 32 kg/m³ (2 pcf), k = 0.04 (0.27) at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F)
- C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

2.2 Mineral wool or refractory fiber

- A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

2.3 RIGID CELLULAR PHENOLIC FOAM

- A. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with vapor retarder and all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.
- B. Equipment Insulation, ASTM C 1126, type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket.

2.4 CELLULAR GLASS CLOSED-CELL

- A. Comply with Standard ASTM C177, C518, density 120 kg/m³ (7.5 pcf) nominal, k = 0.033 (0.29) at 24~~0~~ degrees C (75 degrees F).
- B. Pipe insulation for use at temperatures up to 200 degrees C (400 degrees F) with all service vapor retarder jacket.

2.6 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

ASTM C177, C518, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

2.7 CALCIUM SILICATE

- A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- C. Equipment Insulation: ASTM C533, Type I and Type II
- D. Characteristics:

Insulation Characteristics		
ITEMS	TYPE I	TYPE II
Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m ³ (lb/ ft ³)	232 (14.5)	288 (18)
Thermal conductivity: Min W/ m K (Btu in/h ft ² degrees F)@ mean temperature of 93 degrees C (200 degrees F)	0.059 (0.41)	0.078 (0.540)
Surface burning characteristics: Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

2.8 INSULATION FACINGS AND JACKETS

- A. Vapor Retarder, higher strength with low water permeance \leq 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.

- B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.
- D. Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity areas conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.
- E. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.
- F. Factory composite materials may be used provided
- G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.
- H. Aluminum Jacket-Piping systems and circular breeching and stacks: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.6 mm (0.024) inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same

alloy. Factory-fabricated stainless steel bands shall be installed on all circumferential joints. Bands shall be 13 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

- I. Aluminum jacket-Rectangular breeching: ASTM B209, 3003 alloy, H-14 temper, 0.5 mm (0.020 inches) thick with 32 mm (1-1/4 inch) corrugations or 0.8 mm (0.032 inches) thick with no corrugations. System shall be weatherproof if used for outside service.

2.9 PIPE COVERING PROTECTION SADDLES

- A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

- B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

2.10 ADHESIVE, MASTIC, CEMENT

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
- C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.

- E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
- F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- G. Other: Insulation manufacturers' published recommendations.

2.11 MECHANICAL FASTENERS

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching galvanized steel
- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
- D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.12 REINFORCEMENT AND FINISHES

- A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
- E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
- F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

2.13 FIRESTOPPING MATERIAL

Other than pipe insulation, refer to Section 07 84 00 FIRESTOPPING.

2.14 FLAME AND SMOKE

Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

PART 3 - EXECUTION**3.1 GENERAL REQUIREMENTS**

- A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Where removal of insulation of piping and equipment is required to comply with Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT and Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.
- D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).
- E. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.
- F. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- H. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight

system. Access doors and other items requiring maintenance or access shall be removable and sealable.

I. Plumbing work not to be insulated:

1. Piping and valves of fire protection system.
2. Chromium plated brass piping.
3. Water piping in contact with earth.
4. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).
5. Distilled water piping.

J. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

K. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights.

Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

L. Firestop Pipe insulation:

1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
 - a. Pipe risers through floors
 - b. Pipe chase walls and floors
 - c. Smoke partitions
 - d. Fire partitions

M. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (0.75) thick insulation, for all pipe sizes 75 mm(3 inches) and smaller and 25 mm(1inch) thick insulation for larger pipes. Provide metal jackets for all pipes. Provide for cold water make-up where indicated on the drawings as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).

N. Provide vapor barrier jackets over insulation as follows:

1. All piping exposed to outdoor weather.
2. All interior piping conveying fluids exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.) in high humidity areas.

O. Provide metal jackets over insulation as follows:

- a. All plumbing piping exposed to outdoor weather.
- b. Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
- c. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:

1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
2. Plain board:
 - a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
 - b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.
 - c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
3. Cold equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
 - a. Water filter, chemical feeder pot or tank.
 - b. Pneumatic, cold storage water and surge tanks.
4. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
 - a. Domestic water heaters and hot water storage tanks (not factory insulated).

- b. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.

B. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
 - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
 - b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
 - c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
 - d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

C. Rigid Cellular Phenolic Foam:

1. Rigid closed cell phenolic insulation may be provided for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
2. Note the NFPA 90A burning characteristics requirements of 25/50 in paragraph 1.3.B

3. Provide secure attachment facilities such as welding pins.
4. Apply insulation with joints tightly drawn together
5. Apply adhesives, coverings, neatly finished at fittings, and valves.
6. Final installation shall be smooth, tight, neatly finished at all edges.
7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
8. Condensation control insulation: Minimum 25 mm (1.0 inch) thick for all pipe sizes.
 - a. Plumbing piping as follows:
 - 1) Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.
 - 2) Waste piping from electric water coolers and icemakers to drainage system.
 - 3) Waste piping located above basement floor from ice making and film developing equipment and air handling units, from equipment(including trap) to main vertical waste pipe.
 - 4) MRI quench vent piping.
 - 5) Bedpan sanitizer atmospheric vent
 - 6)Cold water piping.

D. Cellular Glass Insulation:

1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.
2. Underground Piping Other than or in lieu of that Specified in Section 22 11 00, FACILITY WATER DISTRIBUTION: Type II, factory jacketed with a 3 mm laminate jacketing consisting of 3000 mm x 3000 mm (10 ft x 10 ft) asphalt impregant4ed glass fabric, bituminous mastic and outside protective plastic film.
 - a. 75 mm (3 inches) thick for hot water piping.
 - b. As scheduled at the end of this section for chilled water piping.
 - c. Underground piping: Apply insulation with joints tightly butted. Seal longitudinal self-sealing lap. Use field fabricated or factory made fittings. Seal butt joints and fitting with jacketing as recommended by the insulation manufacturer. Use 100 mm (4 inch) wide strips to seal butt joints.
 - d. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.

- e. Underground insulation shall be inspected and approved by the Resident Engineer as follows:
 - 1) Insulation in place before coating.
 - 2) After coating.
- f. Sand bed and backfill: Minimum 75 mm (3 inches) all around Insulated pipe or tank, applied after coating has dried.
- 3. Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ.

F. Flexible Elastomeric Cellular Thermal Insulation:

- 1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
- 2. Pipe and tubing insulation:
 - a. Use proper size material. Do not stretch or strain insulation.
 - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
 - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
- 3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
- 4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.

G. Calcium Silicate:

- 1. Minimum thickness in millimeter (inches) specified below for piping other than in boiler plant.

Nominal Thickness Of Calcium Silicate Insulation (Non-Boiler Plant)				
Nominal Pipe Size Millimeters (Inches)	Thru 25 (1)	32 to 75 (1-1/4 to 3)	100-200 (4 to 6)	Over 200 (6)
93-260 degrees C (200-500 degrees F) (HPS, HPR)	100 (4)	125 (5)	150 (6)	150 (6)

2. MRI Quench Vent Insulation: Type I, class D, 150 mm (6 inch) nominal thickness.

3.3 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of section 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to section 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.4 PIPE INSULATION SCHEDULE

Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 - 32 (1 - 1¼)	38 - 75 (1½ - 3)	100 (4) and Above
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Rigid Cellular Phenolic Foam (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)

38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Polyiso- cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	----	----
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	----
4-16 degrees C (40-60 degrees F)	Rigid Cellular Phenolic Foam (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
4-16 degrees C (40-60 degrees F)	Polyiso- cyanurate Closed-Cell Rigid(Exterior Locations only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
(4-16 degrees C (40-60 degrees F)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)

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SECTION 22 11 00**FACILITY WATER DISTRIBUTION****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

- A. Section 07 84 00, FIRESTOPPING.
- B. Section 09 91 00, PAINTING.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, PIPE INSULATION.
- E. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS: Requirements for commissioning, systems readiness checklist, and training.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
 - American Society of Mechanical Engineers (ASME): (Copyrighted Society)
 - A13.1.....Scheme for Identification of Piping Systems
 - B16.3-2011.....Malleable Iron Threaded Fittings Classes 150 and 300
 - B16.9-2007.....Factory-Made Wrought Butt Welding Fittings
 - B16.11-2011.....Forged Fittings, Socket-Welding and Threaded
 - B16.12-2009Cast Iron Threaded Drainage Fittings
 - B16.15-2006Cast Copper Alloy Threaded Fittings Classes 125 and 250
 - B16.18-2001 (R2005).....Cast Copper Alloy Solder-Joint Pressure Fittings

- B16.22-2012.....Wrought Copper and Copper Alloy Solder Joint
Pressure Fittings
- B16.51-2011.....Copper and Copper Alloy Press-Connect Fittings
- NSF/ANSI 61-2012.....Drinking Water System Components - Health
Effects
- C. American Society for Testing and Materials (ASTM):
- A47/A47M-99(2009).....Ferritic Malleable Iron Castings
- A53/A53M-12.....Pipe, Steel, Black and Hot-Dipped, Zinc Coated
Welded and Seamless
- A183-03(2009).....Carbon Steel Track Bolts and Nuts
- A269-10.....Seamless and Welded Austenitic Stainless Steel
Tubing for General Service
- A312/A312M-12.....Seamless, Welded, and Heavily Cold Worked
Austenitic Stainless Steel Pipes
- A403/A403M-12.....Wrought Austenitic Stainless Steel Piping
Fittings
- A536-84(2009).....Ductile Iron Castings
- A733-03(2009)e1.....Welded and Seamless Carbon Steel and Austenitic
Stainless Steel Pipe Nipples
- B32-08.....Solder Metal
- B61-08.....Steam or Valve Bronze Castings
- B62-09.....Composition Bronze or Ounce Metal Castings
- B75/B75M-11.....Seamless Copper Tube
- B88-09.....Seamless Copper Water Tube
- B584-12a.....Copper Alloy Sand Castings for General
Applications
- B687-99(2011).....Brass, Copper, and Chromium-Plated Pipe Nipples
- D1785-12.....Poly (Vinyl Chloride) (PVC) Plastic Pipe,
Schedules 40, 80, and 120
- D2000-12.....Rubber Products in Automotive Applications
- D4101-11.....Propylene Plastic Injection and Extrusion
Materials
- D2564-04(2009) e1.....Solvent Cements for Poly (Vinyl Chloride) (PVC)
Plastic Pipe and Fittings
- E1120-08.....Liquid Chlorine
- E1229-08.....Calcium Hypochlorite
- D. American Water Works Association (AWWA):
- C110/A21.10-12.....Ductile Iron and Gray Iron

- C151/A21.51-09.....Ductile-Iron Pipe, Centrifugally Cast
- C153/A21.53-11.....Ductile-Iron Compact Fittings
- C203-08.....Coal-Tar Protective Coatings and Linings for
Steel Water Pipelines - Enamel and Tape - Hot
Applied
- C213-07.....Fusion Bonded Epoxy Coating for the Interior &
Exterior of Steel Water Pipelines
- C651-05.....Disinfecting Water Mains
- E. American Welding Society (AWS):
- A5.8/A5.8M-2011.....Filler Metals for Brazing
- F. International Plumbing Code
- International Plumbing Code - 2009
- G. American Society of Sanitary Engineers (ASSE):
- ANSI/ASSE 1001-2008.....Pipe Applied Atmospheric Type Vacuum Breakers
- ANSI/ASSE 1010-2004.....Water Hammer Arresters
- ANSI/ASSE 1018-2001.....Trap Seal Primer Valves - Potable Water
Supplied
- ANSI/ASSE 1020-2004.....Pressure Vacuum Breaker Assembly
- H. Plumbing and Drainage Institute (PDI):
- PDI WH-201 2010.....Water Hammer Arrestor

1.5 QUALITY ASSURANCE

- A. A certificate of Welder's certification shall be submitted prior to welding of steel piping. The certificate shall be current and no more than one year old.
- B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.
- C. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.6 SPARE PARTS

- A. For mechanical press-connect fittings, provide tools required for each pipe size used at the facility.

PART 2 - PRODUCTS

2.1 UNDERGROUND WATER SERVICE CONNECTIONS TO BUILDINGS

- A. From inside face of exterior wall to a distance of approximately 5 feet (1500 mm) outside of building and underground inside building, material to be the same for the size specified inside of the building.

- B. Three inches (75 mm) Diameter and Over: Ductile iron, AWWA C151, 125 psi (850 kPa) water steam pressure (WSP), exterior bituminous coating, and cement lined. Provide flanged and anchored connection to interior piping.
- C. Under 3 inch (75 mm) Diameter: Copper tubing, ASTM B88, Type K, seamless, annealed. Fittings as specified under Article 2.2, INTERIOR DOMESTIC WATER PIPING. Use brazing alloys, AWS A5.8, Classification BCuP.

2.2 ABOVE GROUND (INTERIOR) WATER PIPING

- A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 6 inches (150 mm) and larger, stainless steel, ASTM A312, schedule 10 shall be used.
- B. Fittings for Copper Tube:
 - 1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & SP 110, Solder or braze joints. Use 95/5 tin and antimony for all soldered joints.
 - 2. Grooved fittings, 2 to 6 inch (50 to 150 mm) wrought copper ASTM B75 C12200, 5 to 6 inch (125 to 150 mm) bronze casting ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
 - 3. Mechanical press-connect fittings for copper pipe and tube shall conform to the material and sizing requirements of ASME B16.51, NSF/ANSI 61 approved, 2 inch (50 mm) size and smaller mechanical press-connect fittings, double pressed type, with EPDM (ethylene propylene diene monomer) non-toxic synthetic rubber sealing elements and un-pressed fitting identification feature.
 - 4. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall ensure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.
- C. Fittings for Stainless Steel:
 - 1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ANSI B16.9.

2. Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
- D. Adapters: Provide adapters for joining screwed pipe to copper tubing.
- E. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.
- F. Brazing alloy: AWS A5.8, Classification BCuP.

2.3 EXPOSED WATER PIPING

- A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
 1. Pipe: Fed. Spec. WW-P-351, standard weight.
 2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish.
 3. Nipples: ASTM B 687, Chromium-plated.
 4. Unions: Mss SP-72, SP-110, Brass or Bronze with chrome finish. Unions 2-1/2 inches (65 mm) and larger shall be flange type with approved gaskets.
- B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

2.4 ETHYLENE OXIDE (ETO) STERILIZER WATER SUPPLY PIPING

- A. Stainless steel, ASTM A312, Schedule 10 with stainless steel butt welded fittings. Provide on sterilizer water supply.

2.5 TRAP PRIMER WATER PIPING:

- A. Pipe: Copper tube, ASTM B88, type K, hard drawn.
- B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.
- C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

2.6 STRAINERS

- A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.

- C. Body: Smaller than 3 inches (80 mm), brass or bronze; 3 inches (80 mm) and larger, cast iron or semi-steel.

2.7 DIELECTRIC FITTINGS

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

2.8 STERILIZATION CHEMICALS

- A. Hypochlorite: ASTM E1120-08
- B. Liquid Chlorine: ASTM E1229-08

2.9 WATER HAMMER ARRESTER:

- A. Closed copper tube chamber with permanently sealed 60 psig (410 KpA) air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements (PDI-WH 201). Provide water hammer arrestors at:
 - 1. All solenoid valves.
 - 2. All groups of two or more flush valves.
 - 3. All quick opening or closing valves.
 - 4. All medical washing equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with the International Plumbing Code and the following:
 - 1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
 - 2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
 - 3. All pipe runs shall be laid out to avoid interference with other work.
 - 4. Install union and shut-off valve on pressure piping at connections to equipment.
 - 5. Pipe Hangers, Supports and Accessories:
 - a. All piping shall be supported per the International Plumbing Code.

- b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with red lead or zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
- c. Floor, Wall and Ceiling Plates, Supports, Hangers:
 - 1) Solid or split un-plated cast iron.
 - 2) All plates shall be provided with set screws.
 - 3) Pipe Hangers: Height adjustable clevis type.
 - 4) Adjustable Floor Rests and Base Flanges: Steel.
 - 5) Concrete Inserts: "Universal" or continuous slotted type.
 - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 - 7) Riser Clamps: Malleable iron or steel.
 - 8) Rollers: Cast iron.
 - 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
 - 10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
 - 11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
 - 12) With the installation of each flexible expansion joint, provide piping restraints for the upstream and downstream section of the piping at the flexible expansion joint. Provide calculations supporting the restraint length design and type of selected restraints.
- 6. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- 7. Penetrations:

- a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
 - b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00.
- 8. Mechanical press-connect fitting connections shall be made in accordance with the manufacturer's installation instructions. Depth of insertion must be marked on the tube prior to inserting the tube into the fitting. Ensure the tube is completely inserted to the fitting stop (appropriate depth) and squared with the fitting prior to applying the pressing jaws onto the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer. Minimum distance between fittings shall be in accordance with the manufacturer's requirements. When the pressing cycle is complete, visually inspect the joint to ensure the tube has remained fully inserted, as evidenced by the visible insertion mark.
- B. Piping shall conform to the following:
 - 1. Domestic Water:
 - a. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot water circulating lines with no traps.
 - b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

3.2 TESTS

- A. General: Test system either in its entirety or in sections. Submit testing plan to Resident Engineer/COR 14 days prior to test date.
- B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 150 psi (1040 kPa) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage

with a shutoff and bleeder valve at the highest point of the piping being tested.

- C. Re-agent Grade Water Systems: Fill system with water and maintain hydrostatic pressure of 200 psi (1040 kPa) gage during inspection and prove tight.
- D. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.

3.3 STERILIZATION

- A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.
- B. Use liquid chlorine or hypochlorite for sterilization.

3.4 COMMISSIONING

- A. Provide commissioning documentation accordance with the requirements of Section 22 08 00.
- B. Components provided under this section of the specification will be tested as part of a larger system.

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SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Hot water recirculation.

1.2 RELATED WORK

- A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- B. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
- C. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS.

Requirements for commissioning, systems readiness checklist, and training.

- D. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

- A. Domestic Water Pressure Booster System:

1. Components shall be furnished by a single manufacturer and the system shall be the standard cataloged product of the manufacturer.
2. Shop Test: Water booster unit and its component parts shall undergo a thorough electric and hydraulic operating test prior to shipment. Tests shall include a system operating flow test from zero to 100 percent of design flow rate under specified suction and system pressure conditions. Certified performance curves shall be furnished.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Manufacturer's Literature and Data:

1. Pump:
 - a. Manufacturer and model.
 - b. Operating speed.
 - c. Capacity.

- d. Characteristic performance curves.
- 2. Motor:
 - a. Manufacturer.
 - b. Speed.
 - c. Current Characteristics.
 - d. Efficiency.
- C. Certificate of shop test for domestic water booster system. Provide certified performance curves.
- D. Certified copies of all the factory and construction site test data sheets and reports.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
 - 1. Include complete list indicating all components of the systems.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- F. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Electrical Manufacturers Association (NEMA):
 - ICS6-93 (R2006).....Industrial Control and Systems Enclosures
 - 250-08.....Enclosures for Electrical Equipment (1000 Volts Maximum)

C. American Society of Mechanical Engineers (ASME):

Boiler and Pressure Vessel Code: 2010

Section VIII.....Pressure Vessels, Division I and II

D. Underwriters' Laboratories, Inc. (UL):

508-99 (R2008)..... Standards for Industrial Control Equipment

PART 2 - PRODUCTS

2.1 INLINE HOT WATER RECIRCULATING PUMP

- A. Centrifugal in-line horizontal oil lubricated pump designed for quiet operation and 862 kPa (125 psi).
 - B. Bronze body construction capable of pumping ____ LPM (____GPM) @ ____ Meters of head (____ Feet of head) when drive by ____ HP single phase, ____ VAC motor. Pump shall be non-overloading at any point on the pump curve.
 - C. Pump controlled from on/off aquastat located at pump. In addition, the pump shall be provided with "on-off" switch for shut down. In the inlet and outlet piping of the pump shutoff valves shall be installed to permit service to the pump without draining the system. A check valve shall be installed in the pump discharge piping immediately downstream
- PART 3 - EXECUTION

3.1 STARTUP AND TESTING

- A. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. System Test: After installation is completed provide an operational test of the completed system including flow rates, pressure compliance, alarms and all control functions.
- C. When any defects are detected, correct defects and repeat test.
- D. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior to notice.

3.2 COMMISSIONING

- A. Provide Commissioning Documentation accordance with the requirements of Section 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS for all inspection, startup, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this Section of the specification will be tested as part of a larger system. Refer to Section 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.3 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

- - - E N D - - -

**SECTION 22 13 00
FACILITY SANITARY AND VENT PIPING**

PART 1 - GENERAL

1.1 DESCRIPTION

This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

- A. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.
- B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.
- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Pipe Insulation.
- E. Section 07 92 00 Joint Sealants: Sealant products.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Piping.
 - 2. Floor Drains.
 - 3. Cleanouts.
 - 4. All items listed in Part 2 - Products.
- C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME): (Copyrighted Society)
 - A112.6.3-01 (R 2007)....Standard for Floor and Trench Drains
 - A13.1-07.....Scheme for Identification of Piping Systems
 - B16.3-06.....Malleable Iron Threaded Fittings, Classes 150 and 300.
 - B16.4-06.....Standard for Grey Iron Threaded Fittings
Classes 125 and 250

B16.12-98 (R 2006).....Cast Iron Threaded Drainage Fittings
 B16.15-06.....Cast Bronze Threaded Fittings, Classes 125 and
 250

C. American Society for Testing and Materials (ASTM):

A47/A47M-99 (R 2004)....Standard Specification for Steel Sheet,
 Aluminum Coated, by the Hot Dip Process
 A53/A53M-07.....Standard Specification for Pipe, Steel, Black
 And Hot-Dipped, Zinc-coated, Welded and
 Seamless
 A74-06.....Standard Specification for Cast Iron Soil Pipe
 and Fittings
 A183-03.....Standard Specification for Carbon Steel Track
 Bolts and Nuts
 A536-84(R 2004).....Standard Specification for Ductile Iron
 Castings
 B32-08.....Standard Specification for Solder Metal
 B75-02.....Standard Specification for Seamless Copper Tube
 B306-02.....*Standard Specification for Copper Drainage Tube*
 (DWV)
 B584-06a.....Standard Specification for Copper Alloy Sand
 Castings for General Applications
 C564-03a.....Standard Specification for Rubber Gaskets for
 Cast Iron Soil Pipe and Fittings
 D2000-08.....Standard Classification System for Rubber
 Products in Automotive Applications
 D2564-04E1.....Standard Specification for Solvent Cements for
 Poly (Vinyl Chloride) (PVC) Plastic Pipe and
 Fittings
 D2665-08.....*Standard Specification for Poly (Vinyl*
Chloride) (PVC) Plastic Drain, Waste, and Vent
Pipe and Fittings

D. International Code Council:

IPC-06.....International Plumbing Code

E. Cast Iron Soil Pipe Institute (CISPI):

301-05.....Hubless Cast Iron Soil Pipe and Fittings for
 Sanitary and Storm Drain, Waste, and Vent
 Piping Applications

310-04.....Coupling for Use in Connection with Hubless
Cast Iron Soil Pipe and Fittings for Sanitary
and Storm Drain, Waste, and Vent Piping
Applications

F. American Society of Sanitary Engineers (ASSE):

1018-01.....Trap Seal Primer Valves - Potable, Water
Supplied

G. Plumbing and Drainage Institute (PDI):

PDI WH-201.....Water Hammer Arrestor

PART 2 - PRODUCTS

2.1 SANITARY WASTE, DRAIN, AND VENT PIPING

A. Cast iron waste, drain, and vent pipe and fittings

1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:
 - a. interior waste and vent piping above grade.
2. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A-888, or ASTM A-74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM Standard C-564 or be installed with lead and oakum.

B. Copper Tube, (DWV):

1. Copper DWV tube sanitary waste, drain and vent pipe may be used for piping above ground, except for urinal drains.
2. The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
3. The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME 16.29.
4. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

C. Polyvinyl Chloride (PVC)

1. Polyvinyl chloride (PVC) pipe and fittings are permitted where the waste temperature is below 60°C (140°F).
2. PVC piping and fittings shall NOT be used for the following applications:
 - a. Waste collected from steam condensate drains
 - b. spaces such as mechanical equipment rooms, kitchens, SPD, and sterilizer areas.
 - b. Vertical waste and soil stacks serving more than two floors
 - c. Exposed in mechanical equipment rooms.
 - d. Exposed inside of ceiling return plenums
3. Polyvinyl chloride sanitary waste, drain, and vent pipe and fittings shall be schedule 40 solid core sewer piping conforming to ASTM D 1785 and ASTM D2665, sewer and drain series with ends for solvent cemented joints.
4. Fittings:
 - a. PVC fittings shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

2.2 EXPOSED WASTE PIPING

- A. Full iron pipe size chrome plated brass piping shall be used in finished rooms for exposed waste piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
 1. The Pipe shall meet Fed. Spec. WW-P-351, standard weight.
 2. The Fittings shall conform to ANSI B16.15, cast bronze threaded fittings with chrome finish, (125 and 250).
 3. Nipples shall conform to ASTM B 687, Chromium-plated.
 4. Unions shall be brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.
- B. In unfinished Rooms such as mechanical Rooms and Kitchens, Chrome-plated brass piping is not required. The pipe materials specified under the paragraph "Sanitary Waste, Drain, and Vent Piping" can be used. The sanitary pipe in unfinished rooms shall be painted as specified in Section 09 91 00, PAINTING.

2.3 SPECIALTY PIPE FITTINGS

- A. Transition pipe couplings shall join piping with small differences in outside diameters or different materials. End connections shall be of

the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear and corrosion resistant metal, tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
 2. For PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F 477 or ASTM D5926.
 3. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.
- B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 860 kPa (125 psig) at a minimum temperature of 82°C (180°F). The end connection shall be solder joint copper alloy and threaded ferrous.
- C. Dielectric flange insulating kits shall be of non conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.
- D. The di-electric nipples shall be electroplated steel nipple complying with ASTM F 1545 with a pressure ratings of 2070 kPa (300 psig) at 107°C (225°F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.4 CLEANOUTS

- A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); and not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line.
- B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2

inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on drawings and at every building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty type.

- C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

2.5 FLOOR DRAINS

- A. Type A (FD-A) floor drain shall comply with ANSI A112.6.3. A caulking flange, inside gasket, or hubless connection shall be provided for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe. The drain connection shall be bottom outlet. A membrane clamp and extensions shall be provided, if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening will not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe. For drains not installed in connection with a waterproof membrane, a 2.2 kg (16-ounce) soft copper membrane, 600 mm

(24 inches) square or another approved waterproof membrane shall be provided.

- B. Type B (FD-B) floor drain shall comply with ANSI A112.6.3. The type B floor drain shall be constructed of galvanized cast iron with medium duty nickel bronze grate, double drainage pattern, clamping device, without sediment bucket but with secondary strainer in bottom. The grate shall be 175 mm (7 inches) minimum.
- C. Type C (FD-C) floor drain shall comply with ANSI A112.6.3. The type C floor drain shall have a cast iron body, double drainage pattern, clamping device, light duty square or round nickel bronze adjustable strainer and grate with vandal proof screws. The grate shall be square, 150 mm (6 inches) minimum.
- D. Type D (FD-D) floor drain shall comply with ANSI A112.6.3. The type D floor drain shall have a Cast iron body with flange, integral reversible clamping device, seepage openings and 175 mm (7 inch) diameter or square satin nickel bronze or satin bronze strainer with 100 mm (4 inch) flange.
- F. Type F (FD-F) floor drain shall comply with ANSI A112.6.3. The type F floor drain shall be have a cast iron body with flange, integral reversible clamping device, seepage openings and a 225 mm (9 inch) two-piece satin nickel-bronze or satin bronze strainer for use with seamless vinyl floors.
- G. Type G (FD-G) floor drain shall comply with ANSI A112.6.3. The type G floor drain shall have a cast iron body, shallow type with double drainage flange and removable, perforated aluminum sediment bucket. The type G drain shall have all interior and exposed exterior surfaces coated with acid resistant porcelain enamel finish. The floor drain shall have a clamping device. The frame and grate shall be nickel bronze. The grate shall be approximately 200 mm (8 inches) in diameter. The space between body of drain and basket shall be sufficient for free flow of waste water.
- H. Type H (FD-H) floor drain shall comply with ANSI A112.6.3. The type H drain shall have a cast iron body, double drainage pattern, without sediment bucket but with loose set nickel bronze grate, secondary strainer, and integral clamping collar. The grate shall be 300 mm (12 inches) in diameter or 300 mm (12 inches) square. The drain body shall be 150 mm (6 inches) deep.

- I. Type I (FD-I) floor drain shall comply with ANSI A112.6.3. The type I floor drain shall have a cast iron body, wide flange for seamless floor, double drainage pattern, with all interior surfaces and exposed exterior surfaces provided with acid resistant enamel finish. The type I floor drain shall have a clamping device, secured nickel bronze rim, aluminum enameled finish sediment basket with, perforations with not less than 19 300 square mm (30 square inches) of free area. The sediment basket shall be approximately 100 mm (4 inches) deep, and be provided with grips for easy handling. The floor drain shall be provided with a loose-set, nickel bronze grate approximately 300 mm (12 inches) square and of sufficient strength to support pedestrian traffic. Ample space between body of drain and sediment basket shall be provided for free flow of waste liquids.
- M. Type M (FD-M) floor drain shall comply with ANSI A112.6.3 The type M floor drain shall have a cast iron body, nickel bronze adjustable funnel strainer and clamping device. Funnel strainer shall consist of a perforated floor-level square or round grate and funnel extension. Minimum dimensions as follows:
1. Area of strainer and collar - 23 000 square mm (36 square inches).
 2. Height of funnel - 95 mm (3-3/4 inches).
 3. Diameter of lower portion of funnel - 50 mm (2 inches).
 4. Diameter of top portion of funnel - 100 mm (4 inches).
 5. Provide paper collars for construction purposes.
- N. Type N (FD-N) floor drain shall comply with ANSI A112.6.3. The type N floor drain shall have a cast iron body, wide flange for seamless floors, double drainage pattern, with all interior and exposed exterior surfaces provided with acid resistant enamel finish. The type N floor drain shall have a clamping device, secured nickel bronze rim, aluminum enameled finish sediment basket, perforated with not less than 9 000 square mm (14 square inches) of free area and approximately 50 mm (2 inches) deep. The sediment bucket shall be provided with grips for easy handling. The loose-set, nickel bronze grate approximately 200 mm (8 inches) shall be round and of sufficient strength to support pedestrian traffic. Ample space between body of drain and sediment basket shall be provided for free flow of waste liquids.
- P. Type P (FD-P) floor drain shall comply with ANSI A112.6.3. The type P floor drain shall have a cast iron body, double drainage pattern, with all interior and exposed exterior surfaces provided with acid resistant

enamel finish. The type P floor drain shall have a clamping device, secured nickel bronze rim, an aluminum enameled finish sediment basket perforated with not less than .027 square m (42 square inches) of free area and approximately 100 mm (4 inches) deep. The sediment bucket shall be provided with grips for easy handling. The loose-set, nickel bronze grate shall be approximately .0077 square m (12 inches square) and of sufficient strength to support pedestrian traffic. Ample space between body of drain and sediment basket shall be provided for free flow of waste liquids.

- Q. Type R (FD-R) floor drain shall comply with ANSI A112.6.3. The type R floor drain shall have a cast iron body, double drainage pattern and clamping device, less grate and sediment basket but with dome type secondary strainer. The drain shall be 200 mm (8 inches) in diameter or 200 mm (8 inches) square and approximately 150 mm (6 inches) deep. The interior and exposed exterior surfaces and rim shall have an acid resisting finish.
- R. Type S (FD-S) floor sink shall comply with ANSI A112.6.3. The type S floor sink shall be constructed from type 304 stainless steel and shall be 300 mm (12 inches) square, and 200 mm (8 inches deep). The interior surface shall be polished. The double drainage flange shall be provided with weep holes, internal dome strainer, and heavy duty non-tilting loose set grate. A clamping device shall be provided.
- S. Type T (FD-T) floor drain shall comply with ANSI A112.6.3. The type T drain shall be Funnel Type, chemical resistant floor drain with integral p-trap. Double drainage pattern floor drain shall have an integral seepage pan for embedding in floor and weep holes to provide adequate drainage from pan to drain pipe. Floor drain shall be polypropylene, flame retardant, Schedule 40 or 80. An outlet of floor drain shall be suitable for properly jointing perforated or slotted floor-level grate and funnel extension. Minimum dimensions as follows:
 - 1. Height of funnel - 95 mm (3-3/4 inches).
 - 2. Diameter of lower portion of funnel - 50 mm (2 inches).
 - 3. Diameter of top portion of funnel - 100 mm (4 inches).
- T. Type V (FD-V) floor drain shall comply with ANSI A112.6.3. The type V floor drain shall have an oval funnel and cast iron body. Funnel strainer shall consist of a slotted cast iron floor-level grate funnel extension. Minimum dimensions as follows:
 - 1. Area of strainer and collar - 23 000 Square mm (36 square inches).

- 2. Height of funnel - 95 mm (3-7/8 inches).
- 3. Funnel size - 90 by 225 mm (3-1/2 by 9 inches).
- U. Open Sight Drains (OSDs) shall be cast iron, constructed as shown by detail.
- V. Type X (FD-X) floor drain shall comply with ANSI A112.6.3. The type X floor drain shall be a chemical resistant floor drain and integral p-trap. Double drainage pattern floor drain shall have integral seepage pan for embedding in floor and weep holes to provide adequate drainage from pan to drain pipe. Floor drain shall be polypropylene, flame retardant, Schedule 40 or 80. An outlet of floor drain shall be suitable for properly joining a perforated or slotted floor level grate.
- W. Type Y (FD-Y) floor drain shall comply with ANSI A112.6.3. The type Y floor drain shall be suitable for parking decks and constructed of extra heavy duty, galvanized cast iron body with double drainage pattern. The extra heavy duty polished bronze grate shall be not less than 225 mm (9 inches) in diameter with seepage pan and combination membrane flashing clamp, heavy duty support flange, under deck clamp and vandal proof grate.

2.6 TRAPS

A. Traps shall be provided on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints are not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.7 TRAP SEAL PRIMER VALVES AND TRAP SEAL PRIMER SYSTEMS

- A. Trap Primer (TP-2): The trap seal primer valve shall be hydraulic, supply type with a pressure rating of 5.98 kPa (125 psig) and conforming to standard ASSE 1018.
 - 1. The inlet and outlet connections shall be 15 mm or DN15 (NPS ½ inch)
 - 2. The trap seal primer valve shall be fully automatic with an all brass or bronze body.
 - 3. The trap seal primer valve shall be activated by a drop in building water pressure, no adjustment required.

4. The trap seal primer valve shall include a manifold when serving two, three, or four traps.
5. The manifold shall be omitted when serving only one trap.

2.9 WATERPROOFING

- A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.
- B. Walls: See detail shown on drawings.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

- A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.
- B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
- C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
- D. All pipe runs shall be laid out to avoid interference with other work.
- E. The piping shall be installed above accessible ceilings where possible.
- F. The piping shall be installed to permit valve servicing or operation.
- G. Unless specifically indicated on the drawings, the minimum slope shall be 2% slope.
- H. The piping shall be installed free of sags and bends.
- I. Seismic restraint shall be installed where required by code.
- J. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent

lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- K. Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.
- L. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"
- M. Aboveground copper tubing shall be installed according to CDA's "Copper Tube Handbook".
- N. Aboveground PVC piping shall be installed according to ASTM D2665.
Underground PVC piping shall be installed according to ASTM D2321.

3.2 JOINT CONSTRUCTION

- A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- C. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.
- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
 - 2. Pipe sections with damaged threads shall be replaced with new sections of pipe.

- E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.
- F. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

3.3 SPECIALTY PIPE FITTINGS

- A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.
- B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES:

- A. All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications. Where conflicts arise between these the code and Section 22 05 11, the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.
- B. Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
- C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.
- D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
 1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
 2. 80 mm or DN 80 (NPS 3 inch): 1500 mm (60 inches) with 13 mm (1/2 inch) rod.
 3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 to NPS 5): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.
 4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 19 mm (3/4 inch) rod.
 5. 250 mm or DN250 to 300 mm or DN 300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 22 mm (7/8 inch) rod.
- E. The maximum spacing for plastic pipe shall be 1.22 m (4 feet).

- F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).
- G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
1. Solid or split unplated cast iron.
 2. All plates shall be provided with set screws.
 3. Height adjustable clevis type pipe hangers.
 4. Adjustable floor rests and base flanges shall be steel.
 5. Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 7. Riser clamps shall be malleable iron or steel.
 8. Rollers shall be cast iron.
 9. See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, for requirements on insulated pipe protective shields at hanger supports.
- H. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.
- I. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- J. Penetrations:
1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
 2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- K. Piping shall conform to the following:
1. Waste and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm or DN 80 (3 inches) and smaller	2%
100 mm or DN 100 (4 inches) and larger	1%

2. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

3.5 TESTS

- A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.
- B. Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.
 1. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
 2. For an air test, an air pressure of 35 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the air test.
 3. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.
 3. Final Tests: Either one of the following tests may be used.
 - a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with

smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.

- b. Peppermint Test: Introduce (2 ounces) of peppermint into each line or stack.

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**SECTION 22 14 00
FACILITY STORM DRAINAGE**

1.1 DESCRIPTION

This section describes the requirements for storm drainage systems, including piping and all necessary accessories as designated in this section.

1.2 RELATED WORK

- A. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.
- B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.
- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Pipe Insulation.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Piping.
 - 2. Roof Drains.
 - 3. Cleanouts.
 - 4. All items listed in Part 2 - Products.
- C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI).
- C. American Society of Mechanical Engineers (ASME): (Copyrighted Society)
 - A112.21.2m-83.....Roof Drains
 - A13.1-07.....Scheme for Identification of Piping Systems
 - B16.3-06.....Malleable Iron Threaded Fittings, Classes 150 and 300. B16.9-07 Factory-Made Wrought Steel Butt welding Fittings
 - B16.11-05.....Forged Steel Fittings, Socket-Welding and Threaded B16.12-98 (R 2006) Cast Iron Threaded Drainage Fittings

- B16.15-06).....Cast Bronze Threaded Fittings, Class 125 and
250
- B16.18-01 (R 2005).....Cast Copper Alloy Solder-Joint Pressure
Fittings
- B16.22-01 (R 2005).....Wrought Copper and Copper Alloy Solder Joint
Pressure Fittings
- D. American Society for Testing and Materials (ASTM):
- A47-99 (R 2004).....Standard Specification for Steel Sheet,
Aluminum Coated, by the Hot-Dip Process
- A53-07.....Standard Specification for Pipe, Steel, Black
And Hot-Dipped, Zinc-coated Welded and Seamless
- A74-06.....Standard Specification for Cast Iron Soil Pipe
and Fittings
- A183-03).....Standard Specification for Carbon Steel Track
Bolts and Nuts
- A312-03.....Standard Specification for Seamless and Welded
Austenitic Stainless Steel Pipe
- A536-84(R 2004).....Standard Specification for Ductile Iron
Castings
- A733-03.....Standard Specification for Welded and Seamless
Carbon Steel and Austenitic Stainless Steel
Pipe Nipples
- B32-04.....Standard Specification for Solder Metal
- B61-08.....Standard Specification for Steam or Bronze
Castings
- B62-02.....Standard Specification for Composition Bronze
or Ounce Metal Castings
- B75-02.....Standard Specification for Seamless Copper Tube
- B88-03.....Standard Specification for Seamless Copper
Water Tube
- B306-02.....Standard Specification for Copper Drainage Tube
(DWV)
- B584-08.....Standard Specification for Copper Alloy Sand
Castings for General Applications
- B687-99.....Standard Specification for Brass, Copper, and
Chromium-Plated Pipe Nipples
- C564-06a.....Standard Specification for Rubber Gaskets for
Cast Iron Soil Pipe and Fittings

- D2000-08.....Standard Classification System for Rubber
Products in Automotive Applications
- D4101-07.....Standard Specification for Propylene Plastic
Injection and Extrusion Materials
- D2447-03.....Standard Specification for Polyethylene (PE)
Plastic Pipe, Schedule 40 and 80, Based on
Outside Diameter
- D2564-04e1.....Standard Specification for Solvent Cements for
Poly (Vinyl Chloride) (PVC) Plastic Pipe and
Fittings
- D2665-07.....Standard Specification for Poly (Vinyl
Chloride) (PVC) Plastic Drain, Waste, and Vent
Pipe and Fittings
- E. American Welding Society (AWS):
- A5.8-04.....Specification for Filler Metals for Brazing and
Braze Welding
- F. International Code Council (ICC):
- IPC-06.....International Plumbing Code
- G. Cast Iron Soil Pipe Institute (CISPI):
- 301-05.....Hubless Cast Iron Soil and Fittings for
Sanitary and Storm Drain, Waste, and Vent
Piping Applications
- 310-04.....Couplings for Use in Connection with Hubless
Cast Iron Soil and Fittings for Sanitary and
Storm Drain, Waste, and Vent Piping
Applications
- H. Manufacturers Standardization Society of the Valve and Fittings
Industry, Inc. (MSS):
- SP-72-99.....Standard for Ball Valves with Flanged or Butt
Welding For General Purpose
- SP-110-96.....Ball Valve Threaded, Socket Welding, Solder
Joint, Grooved and Flared Ends

SPEC WRITER NOTE: Make material
requirements agree with applicable
requirements specified in the referenced
Applicable Publications. Update and
specify only that which applies to the
project.

PART 2 - PRODUCTS**2.1 STORM WATER DRAIN PIPING****A. Cast Iron Storm Pipe and Fittings:**

1. Cast iron storm pipe and fittings shall be used for the following applications:
 - a. Interior storm piping above grade.
 - b. All mechanical equipment rooms or other areas containing mechanical air handling equipment.
2. The cast iron storm Pipe shall be bell and spigot, or hubless (plain end or no-hub) as required by selected jointing method.
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A-888, or ASTM A-74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM Standard C-564 or be installed with leak and oakum.

B. Copper Tube, (DWV): May be used for piping above ground.

1. The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
2. The Copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME 16.29.
3. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

C. Polyvinyl Chloride (PVC)

1. Polyvinyl chloride storm sewer pipe and fittings are permitted for single story structures except for mechanical equipment rooms and other areas containing air handling equipment or hot water generation equipment.
2. Polyvinyl chloride storm sewer pipe and fittings shall be schedule 40 solid core sewer piping conforming to ASTM D1785 and D 2665, Sewer and Drain Series, with ends for solvent cemented joints.
3. Polyvinyl chloride joints shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

D. Roof drain piping in locations where the outdoor conditions are subject to freezing shall be insulated.

2.2 PUMPED DRAIN PIPING:

- A. Pumped drain piping under 100 mm (4 inches) shall be copper tube conforming to ASTM B88, type K or L. For pumped drain piping 100 mm (4 inches) and above, galvanized steel conforming to A 53, seamless, schedule 40 may be used.
- B. Pumped drain pipe fittings shall comply with the following:
 - 1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22.
 - 2. Unions shall be bronze, Mss SP-72, SP-110. Solder or braze joints.
 - 3. Grooved fittings, 65 mm to 100 mm (2-1/2 to 4 inch) wrought copper ASTM A75 C12200, 125 to 150 mm (5 to 6 inch) bronze castings ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with colored alkyd enamel.
- C. Adapters shall be provided for joining screwed pipe to copper tubing.
- D. The solder shall use a non-corrosive flux conforming to ASTM B32.

2.3 SPECIALTY PIPE FITTINGS

- A. Transition pipe couplings shall join piping with small differences in outside diameters or be of different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear erring and corrosion resistant metal tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:
 - 1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
 - 2. For PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F 477 or ASTM D5926.
 - 3. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.
- B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 860 kPa (125 psig) at a minimum temperature of 82°C (180°F). The end connection shall be solder joint copper alloy and threaded ferrous.
- C. Dielectric flange insulating kits shall be of non conducting materials for field assembly of companion flanges with a pressure rating of 1035

kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.

- D. The dielectric nipples shall be electroplated steel nipple comply with ASTM F 1545 with a pressure ratings of 2070 kPa (300 psig) at 107°C (225°F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.4 CLEANOUTS

- A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. A minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged storm sewer line.
- B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts where shall be provided where indicated on the drawings and at each building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty.
- C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel bronze square frame and stainless steel cover with minimum opening of 150 mm by 150 mm (6 inch by 6 inch) shall be provided at each wall cleanout.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule.

Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.5 ROOF DRAINS AND CONNECTIONS

- A. Roof Drains: Roof Drains (RD) shall be cast iron with clamping device for making watertight connection. Free openings through strainer shall be twice area of drain outlet. For roof drains not installed in connection with a waterproof membrane, a soft copper membrane shall be provided 300 mm (12 inches) in diameter greater than outside diameter of drain collar. An integral gravel stop shall be provided for drains installed on roofs having built up roofing covered with gravel or slag. Integral no-hub, soil pipe gasket or threaded outlet connection shall be provided.
1. Flat Roofs: The roof drain shall have a beehive or dome shaped strainer with integral flange not less than 300 mm (12 inches) in diameter. For an insulated roof, a roof drain with an adjustable drainage collar shall be provided, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp. The Bottom section shall serve as roof drain during construction before insulation is installed.
 2. Canopy Roofs: The roof drain shall have a beehive or dome shaped strainer with the integral flange not larger than 200 mm (8 inches) in diameter. For an insulated roof, the roof drain shall be provided with an adjustable drainage collar, which can be raised or lowered to meet the required insulation heights, sump receiver and deck clamp. Bottom section shall serve as roof drain during construction before insulation is installed.
 3. Promenade Decks: the roof drain shall be the same as for canopy roofs, except decks shall have flat, round, loose, non-slip, bronze grate set in square, non-slip, bronze frame.
 4. Portico Roofs and Gutters: Roof drains shall be horizontal angle type drain with flat bottom and horizontal outlet at the same elevation as the pipe to which it is connected. Strainer shall be removable angle grate type.
 5. Protective Roof Membrane Insulation Assembly: The roof drain shall have a perforated stainless steel extension filter, non puncturing clamp ring, large sump with extra wide roof flange and deck clamp.
 - a. Non pedestrian Roofs: The roof drain shall have large polypropylene or aluminum locking dome.

- b. Pedestrian Roof: The rood drain shall have a bronze promenade top 350 mm (14 inches) square, set in square secured frame support collar.
- 6. Roof Drains, Overflow: Roof Drains identified as overflow drains shall have a 50 mm (2 inch) water dam integral to the drain body.
- 7. Roof drains in areas subject to freezing shall have heat tape and shall be insulated.
- B. Expansion Joints: Expansions joints shall be heavy cast iron with cast brass or copper expansion sleeve having smooth bearing surface working freely against a packing ring held in place and under pressure of a bolted gland ring, forming a water and air tight flexible joint. Asbestos packing is prohibited.
- C. Interior Downspouts: An expansion joint shall be provided, specified above, at top of run on straight, vertical runs of downspout piping 12 m (40 feet) long or more.
- D. Downspout Nozzle: The downspout nozzle fitting shall be of brass, unfinished, with internal pipe thread for connection to downspout.

2.6 WATERPROOFING

- A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproofed caulked joint shall be provided at the top hub.
- B. Walls: See detail shown on drawings.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

- A. The pipe installation shall comply with the requirements of the International code and these specifications.
- B. Branch piping shall be installed from the piping system and connect to all drains and outlets.
- C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
- D. All pipe runs shall be laid out to avoid interference with other work.

- E. The piping shall be installed above accessible ceilings to allow for ceiling panel removal.
- F. Unless otherwise stated on the documents, minimum horizontal slope shall be one inch for every 1.22 m (4 feet) of pipe length.
- G. The piping shall be installed free of sags and bends.
- H. Seismic restraint shall be installed where required by code.
- I. Changes in direction for storm drainage piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep $\frac{1}{4}$ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and $\frac{1}{8}$ bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- J. Buried storm drainage piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.
- K. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"
- L. Aboveground copper tubing shall be installed according to CDA's "Copper Tube Handbook".
- M. Aboveground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.

3.2 JOINT CONSTRUCTION

- A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

- C. Hubless, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.
- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
 - 2. Pipe sections with damaged threads shall be replaced with new sections of pipe.
- E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.
- F. for PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

3.3 SPECIALTY PIPE FITTINGS

- A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.
- B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES:

- A. All piping shall be supported according to the International plumbing code, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications.
- B. Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
- C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.
- D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
 - 1. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.

2. NPS 3 (DN 80): 1500 mm (60 inches) with 13 mm (1/2 inch) rod.
 3. NPS 4 to NPS 5 (DN 100 to DN 125): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.
 4. NPS 6 to NPS 8 (DN 150 to DN 200): 1500 mm (60 inches) with 19 mm (3/4 inch) rod.
 5. NPS 10 to NPS 12 (DN 250 to DN 300): 1500 mm (60 inches) with 22 mm (7/8 inch) rod.
- E. The maximum support spacing for horizontal plastic shall be 1.22 m (4 feet).
- F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).
- G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, Wall and Ceiling Plates shall have the following characteristics:
1. Solid or split unplated cast iron.
 2. All plates shall be provided with set screws.
 3. Height adjustable clevis type pipe hangers.
 4. Adjustable Floor Rests and Base Flanges shall be steel.
 5. Hanger Rods shall be low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 6. Riser Clamps shall be malleable iron or steel.
 7. Roller shall be cast iron.
 8. Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gage steel. The shield shall be sized for the insulation.
- H. Miscellaneous Materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.
- I. Cast escutcheon with set screw shall be installed at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- J. Penetrations:

1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
2. Water proofing: At floor penetrations, Clearances around the pipe shall be completely sealed and made watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

K. Piping shall conform to the following:

1. Storm Water Drain and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm (3 inches) and smaller	2%
100 mm (4 inches) (4 inches) and larger	1%

3.5 TESTS

- A. Storm sewer system shall be tested either in its entirety or in sections.
- B. Storm Water Drain tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.
 1. If entire system is tested with water, tightly close all openings in pipes except the highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
 2. For an air test, an air pressure of 35 kPa (5 psi) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the test.

3. Final Tests: Either one of the following tests may be used.
- a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.
 - b. Peppermint Test: Introduce .06 liters (2 ounces) of peppermint into each line or stack.

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SECTION 22 33 00**ELECTRIC DOMESTIC WATER HEATERS****PART 1 - GENERAL****1.1 DESCRIPTION:**

This section describes the requirements for installing a complete electric domestic water heater system ready for operation including the water heaters, thermometers, and all necessary accessories, connections, and equipment.

1.2 RELATED WORK:

- A. Section 09 91 00, PAINTING: Preparation and finish painting.
- B. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- C. Section 22 11 23, DOMESTIC WATER PUMPS: Circulating Pumps.
- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Heater Insulation.
- E. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING, 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING, and 22 11 00, FACILITY WATER DISTRIBUTION: Piping, Fittings, Valves and Gages.
- F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraint for Equipment.

1.3 QUALITY ASSURANCE:

- A. Comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) for efficiency performance:
 - 1. ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings, "for commercial water heaters."
- B. Electrical components, devices and accessories shall be listed and labeled B as defined in NFPA 70 by a qualified testing agency, and marked for intended location and application.
- C. ASME code construction shall be a vessel fabricated in compliance with the ASME boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects"
- E. The electric domestic water heater shall conform to Section 13 05 41 on Seismic restraint requirements, withstanding Seismic movement without separation of any parts from the equipment when subjected to a Seismic event.

1.4 SUBMITTALS:

- A. Submit manufacturer's literature and data pertaining to the water heater in properly bound package, in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include the following as a minimum:
 - 1. Water Heaters.
 - 2. Pressure and Temperature Relief Valves.
 - 4. Thermometers.
 - 5. Pressure Gages.
 - 6. Vacuum Breakers.
- B. For each electric domestic hot water heater type and size, the following characteristics shall be submitted:
 - 1. Rated Capacities.
 - 2. Operating characteristics.
 - 3. Electrical characteristics.
 - 4. Furnished specialties and accessories.
 - 5. A form U-1 or other documentation stating compliance with the ASME Boiler and Pressure Vessel code.
- C. Shop drawings shall include wiring diagrams for power, signal and control functions.
- D. Seismic qualification certificates shall be submitted that details equipment anchorage components, identifies equipment center of gravity with mounting and anchorage provisions, and whether the seismic qualification certificate is based on an actual test or calculations.
- E. The domestic water heater shall be certified and labeled by a testing agency.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Sanitary Engineering (ASSE):
 - 1005.....Performance Requirements for Water Heater Drain Valves, 20 mm (3/4 inch) size
- C. American National Standard Institute (ANSI):
 - Z21.22B-2001.....Relief Valves for Hot Water Supply Systems
- D. American Society of Mechanical Engineers (ASME):
 - B1.20.1-83(R 2006).....Pipe Threads, General Purpose (Inch)

- B16.5-03.....Standard for Pipe Flanges and Flanged Fittings:
NPS ½ through NPS 24
- B16.24-06.....Cast Copper Alloy Pipe Flanges and Flanged
Fittings: Classes 150, 300, 400, 600, 900,
1500, and 2500.
- PTC 25.3-02.....Pressure Relief Devices
- Section IV-07.....Boiler and Pressure Vessel Code; Section IV,
Recommended Rules for the Care and Operation of
Heating Boilers
- Section VIII D1-07.....Boiler and Pressure Vessel Code, Section VIII,
Pressure Vessels Division 1 -Basic Coverage
- E. National Fire Protection Association (NFPA)
- 70-06.....National Electrical Code
- F. Underwriters Laboratories, Inc. (UL):
- 174-04.....Household Electric Storage Tank Water Heaters
- 1453-04.....Water Heaters, Electric Booster and Commercial
Storage Tank
- 499-05.....Standard for Safety Electric Heating Appliances

1.6 AS-BUILT DOCUMENTATION

- A. The electronic documentation and copies of the Operations and Maintenance Manual, approved submittals, shop drawings, and other closeout documentation shall be prepared by a computer software program complying with Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C 794d). The manufacturer or vendor of the software used to prepare the electronic documentation shall have a Voluntary Product Accessibility Template made available for review and included as part of the Operations and Maintenance Manual or closeout documentation. All available accessibility functions listed in the Voluntary Accessibility Template shall be enabled in the prepared electronic files. As Adobe Acrobat is a common industry format for such documentation, following the document, "Creating Accessible Adobe PDF files, A Guide for Document Authors" that is maintained and made available by Adobe free of charge is recommended."
- B. Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- C. Four sets of operation and maintenance data updated to include submittal review comments shall be inserted into a three ring binder.

All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

PART 2 - PRODUCTS

2.1 ELECTRIC DOMESTIC WATER HEATERS:

- A. The tank construction shall be steel shell, with a inner tank liner complying with NSF 61 for barrier materials for potable water. The inner liner shall be extended into the tappings. The vessel shall be ASME Boiler and Pressure Vessel Code (BPVC), section VIII, fabricated with a pressure rating of 1035 kPa (150 psig)
- B. Tapping (openings) shall be Factory fabricated of materials compatible with the tank and in accordance with appropriate ASME standards B1.20.1 for piping connections, pressure and temperature relief valve, pressure gauge, thermometer, drain valve, anode rods and controls as required. Tappings shall comply with the following:
 - 1. 50 mm or DN50 (2 inch) and smaller: Threaded ends according to ASME B1.20.1.
 - 2. 65 mm or DN65 (2 1/2-inch) and Larger: Flanged ends according to ASME B16.5 for steel and stainless steel flanges, and according to ASME B 16.24.
- C. Tank insulation shall comply with ASHRAE 90.1.
- D. For domestic hot water heater sizes greater than 9 KW, the heating element shall be arranged in multiples of three elements. For heaters less than 9 KW, the heater elements shall be arranged in single elements.
- E. The domestic hot water heaters shall have screw in or bolt in immersion type, thermostatically adjustable. Set thermostat for maximum water temperature of 55°C (130°F). The electrical characteristics are scheduled on the drawings.

- F. Combination Pressure and Temperature Relief Valves shall be ASME rated and stamped for combination temperature and pressure relief valves. One or more relief valves with total relieving capacity at least as great as the heat input shall be included. The pressure setting shall be less than the domestic water heater working pressure rating.
- G. the anode rod shall be replaceable magnesium.
- H. the drain valve shall be corrosion resistant metal complying with ASSE 1005.

2.4 ELEVATED ELECTRIC WATER HEATER DRAIN PAN

- A. A stainless steel drain pan shall be provided that is large enough to contain the volume of the heater. The drain pan shall include a drain outlet not less than 20 millimeter or DN 20 (NPS ¾") with ASME B1.20.7 garden hose threads.

2.5 HEAT TRAPS

- A. Heat traps shall be installed in accordance with ASHRAE 90.1, latest edition.

2.6 COMBINATION TEMPERATURE AND PRESSURE RELIEF VALVES

- A. The combination temperature and pressure relief valves shall be ASME rated and stamped and include a relieving capacity at least as great as the heat input and include a pressure setting less than the water heater's working pressure rating.

2.7 THERMOMETERS:

The thermometers shall be straight stem, iron case, red reflecting mercury thermometer or red liquid-filled thermometers, approximately 175 mm (7 inches) high, 4 to 115°C (40 to 240°F).

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Water heaters shall be installed on concrete bases unless elevated above the floor. Refer to Specification Section 03 30 00, CAST-IN-PLACE CONCRETE and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
- B. The water heaters shall be installed level and plumb and securely anchored.
- C. The water heaters shall be installed and connected in accordance with manufacturer's written instructions.
- D. All pressure and temperature relief valves discharge shall be piped to nearby floor drains.
- E. Thermometers shall be installed on the water heater inlet and outlet piping.

- F. The thermostatic control shall be set for a maximum setting of 54 degrees C (130 degrees F).
- G. Shutoff valves shall be installed on the domestic water supply piping to the water heater and on the domestic hot water outlet piping.
- H. All manufacturers's required clearances shall be maintained.
- J. A combination temperature and pressure relief valve shall be installed at the top portion of the storage tank. The sensing element shall extend into the tank. The relief valve outlet drain piping shall discharge by positive air gap into a floor drain.
- K. Piping type heat traps shall be installed on the inlet and outlet piping of the electric domestic hot water heater storage tanks.
- L. Water heater drain piping shall be installed as indirect waste to spill by positive air gap into open drains or over floor drains. Hose end drain valves shall be installed at low points in water piping for electric domestic hot water heaters without integral drains.

3.2 LEAKAGE TEST:

Before piping connections are made, water heaters shall be tested with hydrostatic pressure of 1375 kPa (200 psi) and 1654 kPa (240 psi) for a unit with a MAWP of 1103 kPa (160 psi). Any domestic water heater leaking water shall be replaced with a new unit at no additional cost to the VA.

3.3 PERFORMANCE TEST:

All of the remote water outlets shall have a minimum of 49°C (120°F) and a maximum of 54°C (130°F) water flow at all times. If necessary, make all corrections to balance the return water system or reset the thermostat to make the system comply with design requirements.

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

1.2 RELATED WORK

- A. Sealing between fixtures and other finish surfaces: Section 07 92 00, JOINT SEALANTS.
- B. Flush panel access doors: Section 08 31 13, ACCESS DOORS AND FRAMES.
- C. Through bolts: Section 10 21 13, TOILET COMPARTMENTS.
- D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- E. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
Requirements for commissioning, systems readiness checklist, and training.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit plumbing fixture information in an assembled brochure, showing cuts and full detailed description of each fixture.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standard Institute (ANSI):
The American Society of Mechanical Engineers (ASME):
A112.6.1M-02(R2008).....Floor Affixed Supports for Off-the-Floor
Plumbing Fixtures for Public Use
A112.19.1M-08Enameled Cast Iron Plumbing Fixtures
A112.19.2M-03.....Vitreous China Plumbing Fixtures
A112.19.3-2001(R2008)...Stainless Steel Plumbing Fixtures (Designed for
Residential Use)
- C. American Society for Testing and Materials (ASTM):
A276-2010Stainless and Heat-Resisting Steel Bars and
Shapes
WW-P-541-E/GENPlumbing Fixtures with Amendment 1

- D. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM
AMP 500-505
Metal Finishes Manual (1988)
- E. American Society of Sanitary Engineers (ASSE):
1016-05.....Performance Requirements for Individual
Thermostatic, Pressure Balancing and Combination
Pressure Balancing and Thermostatic Control
Valves for Individual Fixture Fittings
- F. National Sanitation Foundation (NSF)/American National Standards
Institute (ANSI):
61-2009Drinking Water System Components-Health Effects
- G. American with Disabilities Act (A.D.A) Section 4-19.4 Exposed Pipes and
Surfaces
- H. Environmental Protection Agency EPA PL 93-523 1974; A 1999) Safe
Drinking Water Act.
- I. International Building Code, ICC IPBC 2009.

PART 2 - PRODUCTS

2.1 STAINLESS STEEL

- A. Corrosion-resistant Steel (CRS):
 - 1. Plate, Sheet and Strip: CRS flat products shall conform to chemical composition requirements of any 300 series steel specified in ASTM A276.
 - 2. Finish: Exposed surfaces shall have standard polish (ground and polished) equal to NAAMM finish Number 4.
- B. Die-cast zinc alloy products are prohibited.

2.2 STOPS

- A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in wood and metal casework, laboratory furniture and pharmacy furniture. Locate stops centrally above or below fixture in accessible location.
- B. Furnish keys for lock shield stops to Resident Engineer.
- C. Supply from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.
- D. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe, i.e. red brass pipe nipple, chrome plated where exposed.
- E. Psychiatric Area: Provide stainless steel drain guard for all lavatories not installed in casework.

2.3 ESCUTCHEONS

Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

2.4 LAMINAR FLOW CONTROL DEVICE

- A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.
- B. Flow Control Restrictor:
 - 1. Capable of restricting flow from 95 ml/s to 110 ml/s (1.5 gpm to 1.7 gpm) for lavatories; 125 ml/s to 140 ml/s (2.0 gpm to 2.2 gpm) for sinks P-505 through P-520, P-524 and P-528; and 170 ml/s to 190 ml/s (2.75 gpm to 3.0 gpm) for dietary food preparation and rinse sinks or as specified.
 - 2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 kPa and 550 kPa (25 psi and 80 psi).
 - 3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-cleaning action, and is capable of easy manual cleaning.

2.5 CARRIERS

- A. ASME/ANSI A112.6.1M, with adjustable gasket faceplate chair carriers for wall hung closets with auxiliary anchor foot assembly, hanger rod support feet, and rear anchor tie down.
- B. ASME/ANSI A112.6.1M, lavatory, // chair carrier for thin wall construction. All lavatory chair carriers shall be capable of supporting the lavatory with a 250-pound vertical load applied at the front of the fixture.
- C. Where water closets, lavatories or sinks are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers. The drainage fitting of the back to back carrier shall be so constructed that it prevents the discharge from one fixture from flowing into the opposite fixture.

2.9 LAVATORIES

- A. Dimensions for lavatories are specified, Length by width (distance from wall) and depth.
- B. Brass components in contact with water shall contain no more than 3 percent lead content by dry weight.

- C. (LAV-1) Lavatory (Sensor Control, ASME/ANSI A112.19.2M, Figure 16)
straight back, approximately 508 mm by 457 mm (20 inches by 18 inches)
and a 102 mm (4 inches) minimum apron, first quality vitreous china with
punching for gooseneck spout. Set rim 864 mm (34 inches) above finished
floor.
1. Faucet: Solid cast brass construction, chrome plated, gooseneck spout
with outlet 102 mm to 127 mm (4 inches to 5 inches) above rim.
Electronic sensor operated, 102 mm (4 inches) center set mounting, //
wiring box // 120/24 volt solenoid // plug in transformer // remote
mounted transformer // battery operated electronic module // back
check valves // solid brass hot-cold water mixer adjusted from top
deck with barrier free design control handle // and inline filter.
Provide laminar flow control device. Breaking the light beam shall
activate the water flow. Flow shall stop when user moves away from
light beam. // Provide steel access door with key operated cylinder
lock. See Section 08 31 13, ACCESS DOORS AND FRAMES // All connecting
wiring between transformer, solenoid valve and sensor shall be cut to
length with no excess hanging or wrapped up wiring allowed.
 2. Drain: Cast or wrought brass with flat grid strainer with offset
tailpiece, brass, chrome plated.
 3. Stops: Angle type. See paragraph 2.2.Stops
 4. Trap: Cast copper alloy, 38 mm by 32 mm (1 1/2 inches by 1 1/4
inches)P-trap. Adjustable with connected elbow and 17 gage tubing
extension to wall. Exposed metal trap surface and connection hardware
shall be chrome plated with a smooth bright finish. Set trap parallel
to wall.
 5. Provide cover for drain, stops and trap per A.D.A 4-19.4.

2.10 SINKS AND LAUNDRY TUBS

- A. Dimensions for sinks and laundry tubs are specified, length by width
(distance from wall) and depth.
- B. (CS-1) Clinic Service Sink (Flushing Rim) approximately 508 mm by 635 mm
(20 inches by 25 inches) by 203 mm (8 inches) deep. Support with
ASME/ANSI A112. 6.1M chair carrier and secure with 10 mm (3/8 inch)
bracket studs and nuts. Set sink with rim 762 mm (30 inches) above
finished floor. Provide 762 mm (30 inches) CRS drainboard where
required, without corrugations and with heavy duty CRS brackets.
1. Faucet: Elbow control, wall hung, integral stops, single spout with
19 mm (3/4 inch) hose threaded outlet and pail hook, vacuum breaker
and brace to wall. Outlet 356 mm to 381 mm (14 inches to 15 inches)
from wall. Exposed metal parts shall be chromium plated with a smooth
bright finish. Provide laminar flow control device.

2. Flush valve: Large diaphragm, semi-red brass body, Foot pedal operated, exposed chromium plated flush valve with screwdriver back check straight stop with cap, union outlet, street ells, elevated high pressure vacuum breaker, casing cover, 32 mm (1 1/4 inches) elbow flush connection from finished wall to 38 mm (1 1/2 inches) top spud. Spud coupling, wall and spud flanges.
 3. Bed Pan Washer: Mechanical pedal mixing valve, wall hung, with double self-closing pedal valve with loose key stops, renewable seats and supply from valve to nozzle with wall hook hose connection; 1219 mm (48 inches) of heavy duty rubber hose, with extended spray outlet elevated vacuum breaker, indexed lift up pedals having clearance of not more than 13 mm (1/2 inch) above the floor and not less than 356 mm (14 inches) from wall when in operation. Supply pipe from wall to valve stop shall be rigid, threaded, IPS copper alloy pipe. Exposed metal parts shall be chromium plated with a smooth bright finish. Provide valve plate for foot control. Provide inline laminar flow control device.
- C. (SK-1) Sink (CRS, Single Compartment, Counter Top ASME/ANSI A112.19.2M, Work Station Sink, Figure 5) self rimming, back faucet ledge, approximately 533 mm by 559 mm (21 inches by 22 inches) with single compartment inside dimensions approximately 406 mm by 483 mm by 191 mm (16 inches by 19 inches by 6 inches) deep. Shall be minimum of 1.3 mm thick (18 gauge) CRS. Corners and edges shall be well rounded:
3. Sensor Control: Provide an infra-red photocell sensor and solenoid valve to control flow automatically, thermostatic control valve with check stops, 24 volt transformer, wire box and steel access door with key operated cylinder lock see specification ACCESS DOORS. Operation: Breaking the light beam shall activate the water flow. Flow shall stop when the user moves from the light beam.
 4. Gooseneck spout: Spout and trim shall be solid brass construction and be chromium plated with smooth bright finish. Provide laminar flow device.
 5. Provide cover for drain, stops and trap per A.D.A 4-19.4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section 07 92 00, JOINT SEALANTS.
- B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.

- C. Through Bolts: For free standing marble and metal stud partitions refer to Section 10 21 13, TOILET COMPARTMENTS.
- D. Toggle Bolts: For hollow masonry units, finished or unfinished.
- E. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4 inch) diameter bolts, and to extend at least 76 mm (3 inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.
- F. Power Set Fasteners: May be used for concrete walls, shall be 6 mm (1/4 inch) threaded studs, and shall extend at least 32 mm (1 1/4 inches) into wall.
- G. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.
- H. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.
- I. Do not use aerators on lavatories and sinks.

3.2 CLEANING

At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

3.3 WATERLESS URINAL

Manufacturer shall provide an operating manual and onsite training for the proper care and maintenance of the urinals.

3.4 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS for all inspection, startup, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS and related sections for contractor responsibilities for system commissioning.

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**SECTION 23 05 11
COMMON WORK RESULTS FOR HVAC**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 23.
- B. Definitions:
 - 1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.
 - 3. RE: Resident Engineer
 - 4. COTR: Contracting Officer's Technical Representative.

1.2 RELATED WORK

- A. Section 00 72 00, GENERAL CONDITIONS
- B. Section 01 00 00, GENERAL REQUIREMENTS
- C. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES
- D. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC
- E. Section 23 07 11, HVAC, PLUMBING, and Boiler Plant Insulation
- F. Section 23 31 00, HVAC DUCTS and CASINGS
- G. Section 23 34 00, HVAC FANS
- H. Section 23 36 00, AIR TERMINAL UNITS
- I. Section 23 37 00, AIR OUTLETS and INLETS
- J. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training
- K. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

1.3 QUALITY ASSURANCE

- A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC
- B. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- C. Equipment Vibration Tolerance:

1. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Equipment shall be factory-balanced to this tolerance and re-balanced on site, as necessary.
2. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

D. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.
2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the Resident Engineer.
4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
7. Asbestos products or equipment or materials containing asbestos shall not be used.

E. Equipment Service Organizations:

1. HVAC: Products and systems shall be supported by service organizations that maintain a complete inventory of repair parts and are located within 50 miles to the site.
- F. HVAC Mechanical Systems Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
 1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
 2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
 3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
- G. Execution (Installation, Construction) Quality:
 1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Resident Engineer for resolution. Provide written hard copies or computer files of manufacturer's installation instructions to the Resident Engineer at least two weeks prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations is a cause for rejection of the material.
 2. Provide complete layout drawings required by Paragraph, SUBMITTALS. Do not commence construction work on any system until the layout drawings have been approved.
- H. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and with requirements in the individual specification sections.
- B. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- C. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and

associated systems, including accessibility, are equivalent to that required by the contract.

- D. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- E. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient.
- F. Layout Drawings:
 - 1. Submit complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. Refer to Section 00 72 00, GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION.
 - 2. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed layout drawings of all piping and duct systems.
 - 3. Do not install equipment foundations, equipment or piping until layout drawings have been approved.
 - 4. In addition, for HVAC systems, provide details of the following:
 - a. Mechanical equipment rooms.
 - b. Interstitial space.
 - c. Hangers, inserts, supports, and bracing.
 - d. Pipe sleeves.
 - e. Duct or equipment penetrations of floors, walls, ceilings, or roofs.
- G. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
 - 1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the Resident Engineer.
 - 2. Submit electric motor data and variable speed drive data with the driven equipment.

3. Equipment and materials identification.
 4. Fire-stopping materials.
 5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
 6. Wall, floor, and ceiling plates.
- H. HVAC Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
 2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.
- I. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning, Heating and Refrigeration Institute (AHRI):
430-2009.....Central Station Air-Handling Units
- C. American National Standard Institute (ANSI):
B31.1-2007.....Power Piping
- D. Rubber Manufacturers Association (ANSI/RMA):
IP-20-2007.....Specifications for Drives Using Classical
V-Belts and Sheaves
IP-21-2009.....Specifications for Drives Using Double-V
(Hexagonal) Belts
IP-22-2007.....Specifications for Drives Using Narrow V-Belts
and Sheaves
- E. Air Movement and Control Association (AMCA):
410-96.....Recommended Safety Practices for Air Moving
Devices
- F. American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code (BPVC):
Section I-2007.....Power Boilers
Section IX-2007.....Welding and Brazing Qualifications
Code for Pressure Piping:
B31.1-2007.....Power Piping

G. American Society for Testing and Materials (ASTM):

- A36/A36M-08.....Standard Specification for Carbon Structural Steel
- A575-96(2007).....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
- E84-10.....Standard Test Method for Surface Burning Characteristics of Building Materials
- E119-09c.....Standard Test Methods for Fire Tests of Building Construction and Materials

H. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:

- SP-58-2009.....Pipe Hangers and Supports-Materials, Design and Manufacture, Selection, Application, and Installation
- SP 69-2003.....Pipe Hangers and Supports-Selection and Application
- SP 127-2001.....Bracing for Piping Systems, Seismic - Wind - Dynamic, Design, Selection, Application

I. National Electrical Manufacturers Association (NEMA):

- MG-1-2009.....Motors and Generators

J. National Fire Protection Association (NFPA):

- 31-06.....Standard for Installation of Oil-Burning Equipment
- 54-09.....National Fuel Gas Code
- 70-08.....National Electrical Code
- 85-07.....Boiler and Combustion Systems Hazards Code
- 90A-09.....Standard for the Installation of Air Conditioning and Ventilating Systems
- 101-09.....Life Safety Code

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Resident Engineer. Such repair or replacement shall be at no additional cost to the Government.

3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Government.
4. Boilers shall be left clean following final internal inspection by Government insurance representative or inspector.
5. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.7 JOB CONDITIONS - WORK IN EXISTING BUILDING

- A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities, that serve the medical center.
- B. Maintenance of Service: Schedule all work to permit continuous service as required by the medical center.
- C. Steam and Condensate Service Interruptions: Limited steam and condensate service interruptions, as required for interconnections of new and existing systems, will be permitted by the Resident Engineer during periods when the demands are not critical to the operation of the medical center. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least one week advance notice to the Resident Engineer.
- D. Phasing of Work: Comply with all requirements shown on drawings or specified.
- E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. No storm water or ground water leakage permitted. Provide daily clean-up of construction

and demolition debris on all floor surfaces and on all equipment being operated by VA.

- F. Acceptance of Work for Government Operation: As new facilities are made available for operation and these facilities are of beneficial use to the Government, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

- A. Provide maximum standardization of components to reduce spare part requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
 - 1. All components of an assembled unit need not be products of same manufacturer.
 - 2. Constituent parts that are alike shall be products of a single manufacturer.
 - 3. Components shall be compatible with each other and with the total assembly for intended service.
 - 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. In addition, provide bar

code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.

- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.
- D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.
- E. Valve Tags and Lists:
 - 1. HVAC and Boiler Plant: Provide for all valves other than for equipment in Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.
 - 2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
 - 3. Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
 - 4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

2.4 FIRESTOPPING

Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, for firestop pipe and duct insulation.

2.5 GALVANIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

2.6 DUCT PENETRATIONS

- A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 18 inches high with continuously welded seams, built-in cant

strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.

- B. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly. See section 07 84 00, FIRESTOPPING.

2.7 SPECIAL TOOLS AND LUBRICANTS

- A. Furnish, and turn over to the Resident Engineer, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.
- D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- E. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.8 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.9 ASBESTOS

Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Submit the

drawings for review as required by Part 1. Follow manufacturer's published recommendations for installation methods not otherwise specified.

- B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.
- C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.
- D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- E. Cutting Holes:
 - 1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by Resident Engineer where working area space is limited.
 - 2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by Resident Engineer. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to Resident Engineer for approval.
 - 3. Do not penetrate membrane waterproofing.
- F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- H. Electrical and Pneumatic Interconnection of Controls and Instruments: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.
- I. Protection and Cleaning:
 - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during

- installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- J. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- K. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- L. Install steam piping expansion joints as per manufacturer's recommendations.
- M. Work in Existing Building:
1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
 2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
 3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Resident Engineer. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Resident Engineer for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Resident Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

- N. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 ft.) above the equipment or to ceiling structure, whichever is lower (NFPA 70).
- O. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

- A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.
- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Paragraph 3.1 apply.
- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.3 RIGGING

- A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.
- B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.
- C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

- D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will check structure adequacy and advise Contractor of recommended restrictions.
- E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- F. Rigging plan and methods shall be referred to Resident Engineer for evaluation prior to actual work.
- G. Restore building to original condition upon completion of rigging work.

3.4 CLEANING AND PAINTING

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.
- B. In addition, the following special conditions apply:
 - 1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
 - 2. Material And Equipment Not To Be Painted Includes:
 - a. Motors, controllers, control switches, and safety switches.
 - b. Control and interlock devices.
 - c. Regulators.
 - d. Pressure reducing valves.
 - e. Control valves and thermostatic elements.
 - f. Lubrication devices and grease fittings.
 - g. Copper, brass, aluminum, stainless steel and bronze surfaces.
 - h. Valve stems and rotating shafts.
 - i. Pressure gauges and thermometers.
 - j. Glass.
 - k. Name plates.
 - 3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.

4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
6. Paint shall withstand the following temperatures without peeling or discoloration:
 - a. Condensate and feedwater -- 38 degrees C (100 degrees F) on insulation jacket surface and 120 degrees C (250 degrees F) on metal pipe surface.
 - b. Steam -- 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (375 degrees F) on metal pipe surface.
7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.5 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specifications will be tested as part of a larger system. Refer to Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.6 STARTUP AND TEMPORARY OPERATION

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.7 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS and submit the test reports and records to the Resident Engineer.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make

performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.8 INSTRUCTIONS TO VA PERSONNEL

Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS, and Section 23 08 11, DEMONSTRATIONS AND TESTS FOR BOILER PLANT.

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:

1. Planning systematic TAB procedures.
2. Design Review Report.
3. Systems Inspection report.
4. Duct Air Leakage test report.
5. Systems Readiness Report.
6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
7. Vibration and sound measurements.
8. Recording and reporting results.

B. Definitions:

1. Basic TAB used in this Section: Chapter 37, "Testing, Adjusting and Balancing" of 2007 ASHRAE Handbook, "HVAC Applications".
2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
3. AABC: Associated Air Balance Council.
4. NEBB: National Environmental Balancing Bureau.
5. Hydronic Systems: Includes heating hot water.
6. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
7. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flowrate from values (design) in the contract documents.

1.2 RELATED WORK

- A. Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANTS and STEAM GENERATION: General Mechanical Requirements.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General Mechanical Requirements.
- C. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Piping and Equipment Insulation.
- D. Section 23 31 00, HVAC DUCTS AND CASINGS: Duct Leakage.

- E. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Controls and Instrumentation Settings.
- F. Section 23 37 00, AIR OUTLETS AND INLETS
- G. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS. Requirements for commissioning, systems readiness checklists, and training

1.3 QUALITY ASSURANCE

- A. Refer to Articles, Quality Assurance and Submittals, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC, Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANTS and STEAM GENERATION, and Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Qualifications:
 - 1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
 - 2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.
 - 3. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any

- duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.
4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Resident Engineer. The responsibilities would specifically include:
 - a. Shall directly supervise all TAB work.
 - b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.
 - c. Would follow all TAB work through its satisfactory completion.
 - d. Shall provide final markings of settings of all HVAC adjustment devices.
 - e. Permanently mark location of duct test ports.
 5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing. The lead technician shall be certified by AABC or NEBB
- C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
- D. Tab Criteria:
1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports.
 2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least

100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.

- a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0 percent to plus 10 percent.
- b. Chilled water coils: Minus 0 percent to plus 5 percent.
- 3. Systems shall be adjusted for energy efficient operation as described in PART 3.
- 4. Typical TAB procedures and results shall be demonstrated to the Resident Engineer for one air distribution system (including all fans, three terminal units, three rooms randomly selected by the Resident Engineer) and one hydronic system (pumps and three coils) as follows:
 - a. When field TAB work begins.
 - b. During each partial final inspection and the final inspection for the project if requested by VA.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- C. For use by the Resident Engineer staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
- D. Submit Following for Review and Approval:
 - 1. Design Review Report within 90 days for conventional design projects after the system layout on air and water side is completed by the Contractor.
 - 2. Systems inspection report on equipment and installation for conformance with design.
 - 3. Duct Air Leakage Test Report.
 - 4. Systems Readiness Report.
 - 5. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
 - 6. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

- E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

1.5 APPLICABLE PUBLICATIONS

- A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
2007HVAC Applications ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing and Chapter 47, Sound and Vibration Control
- C. Associated Air Balance Council (AABC):
2002.....AABC National Standards for Total System Balance
- D. National Environmental Balancing Bureau (NEBB):
7th Edition 2005Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems
2nd Edition 2006Procedural Standards for the Measurement of Sound and Vibration
3rd Edition 2009Procedural Standards for Whole Building Systems Commissioning of New Construction
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
3rd Edition 2002HVAC SYSTEMS Testing, Adjusting and Balancing

PART 2 - PRODUCTS

2.1 PLUGS

Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

See Section 23 07 11, HVAC and BOILER PLANT INSULATION Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to TAB Criteria in Article, Quality Assurance.
- B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

The TAB Specialist shall review the Contract Plans and specifications and advise the Resident Engineer of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

- A. Inspect equipment and installation for conformance with design.
- B. The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.
- C. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.4 DUCT AIR LEAKAGE TEST REPORT

TAB Agency shall perform the leakage test as outlined in "Duct leakage Tests and Repairs" in Section 23 31 00, HVAC DUCTS and CASINGS for TAB agency's role and responsibilities in witnessing, recording and reporting of deficiencies.

3.5 SYSTEM READINESS REPORT

- A. The TAB Contractor shall measure existing air and water flow rates associated with existing systems utilized to serve renovated areas as indicated on drawings. Submit report of findings to resident engineer.
- B. Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to RE in standard format and forms prepared and or approved by the Commissioning Agent.
- C. Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Resident Engineer.

3.6 TAB REPORTS

- A. Submit an intermediate report for 50 percent of systems and equipment tested and balanced to establish satisfactory test results.
- B. The TAB contractor shall provide raw data immediately in writing to the Resident Engineer if there is a problem in achieving intended results before submitting a formal report.
- C. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval at no additional cost to the owner.
- D. Do not proceed with the remaining systems until intermediate report is approved by the Resident Engineer.

3.7 TAB PROCEDURES

- A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
- B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.
- C. Coordinate TAB procedures with existing systems and any phased construction completion requirements for the project. Provide TAB reports for pre construction air and water flow rate and for each phase of the project prior to partial final inspections of each phase of the project. Return existing areas outside the work area to pre constructed conditions.
- D. Allow ___ days time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.
- E. Air Balance and Equipment Test: Include air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets.
 - 1. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
 - 2. Variable air volume (VAV) systems:
 - a. Coordinate TAB, including system volumetric controls, with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

- b. Section 23 36 00, AIR TERMINAL UNITS, specifies that maximum and minimum flow rates for air terminal units (ATU) be factory set. Check and readjust ATU flow rates if necessary. Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cubic feet per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode. Record and report outdoor air flow rates under all operating conditions (The test shall demonstrate that the minimum outdoor air ventilation rate shall remain constant under all operating conditions).
 - c. Adjust operating pressure control setpoint to maintain the design flow to each space with the lowest setpoint.
 - 3. Record final measurements for air handling equipment performance data sheets.
- F. Water Balance and Equipment Test: Include circulating pumps, convertors, coils, coolers and condensers:
 - 1. Adjust flow rates for equipment. Set coils and evaporator to values on equipment submittals, if different from values on contract drawings.
 - 2. Primary-secondary (variable volume) systems: Coordinate TAB with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Balance systems at design water flow and then verify that variable flow controls function as designed.
 - 3. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.

3.8 VIBRATION TESTING

- A. Furnish instruments and perform vibration measurements as specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Field vibration balancing is specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide measurements for all rotating HVAC equipment of 373 watts (1/2 horsepower) and larger, including centrifugal/screw compressors, cooling towers, pumps, fans and motors.

- B. Record initial measurements for each unit of equipment on test forms and submit a report to the Resident Engineer. Where vibration readings exceed the allowable tolerance Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the Resident Engineer.

3.9 SOUND TESTING

- A. Perform and record required sound measurements in accordance with Paragraph, QUALITY ASSURANCE in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
1. Take readings in rooms, approximately fifteen (15) percent of all rooms. The Resident Engineer may designate the specific rooms to be tested.
- B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.
- C. Sound reference levels, formulas and coefficients shall be according to ASHRAE Handbook, "HVAC Applications", Chapter 46, SOUND AND VIBRATION CONTROL.
- D. Determine compliance with specifications as follows:
1. When sound pressure levels are specified, including the NC Criteria in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT:
- Reduce the background noise as much as possible by shutting off unrelated audible equipment.
 - Measure octave band sound pressure levels with specified equipment "off."
 - Measure octave band sound pressure levels with specified equipment "on."
 - Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

DIFFERENCE:	0	1	2	3	4	5 to 9	10 or More
FACTOR:	10	7	4	3	2	1	0

Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.

- Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.

2. When sound power levels are specified:
 - a. Perform steps 1.a. thru 1.d., as above.
 - b. For indoor equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level. Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.
 3. Where sound pressure levels are specified in terms of dB(A), as in Section 23 65 00, COOLING TOWERS, measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.
- E. Where measured sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the Resident Engineer and the necessary sound tests shall be repeated.
- F. Test readings for sound testing could go higher than 15 percent if determination is made by the Resident Engineer based on the recorded sound data.

3.10 MARKING OF SETTINGS

Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Resident Engineer.

3.11 IDENTIFICATION OF TEST PORTS

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

3.12 PHASING

- A. Phased Projects: Testing and Balancing Work to follow project with areas shall be completed per the project phasing. Upon completion of the project all areas shall have been tested and balanced per the contract documents.
- B. Existing Areas: Systems that serve areas outside of the project scope shall not be adversely affected. Measure existing parameters where shown to document system capacity.

3.13 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

- - E N D - - -

SECTION 23 07 11
HVAC AND BOILER PLANT INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field applied insulation for thermal efficiency and condensation control for
 - 1. HVAC piping, ductwork and equipment.
- B. Definitions
 - 1. ASJ: All service jacket, white finish facing or jacket.
 - 2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
 - 3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
 - 4. Concealed: Ductwork and piping above ceilings and in chases, interstitial space, and pipe spaces.
 - 5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical, Boiler Plant and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, interstitial spaces, crawl spaces and pipe basements are not considered finished areas.
 - 6. FSK: Foil-scrim-kraft facing.
 - 7. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F); HVAC equipment or piping handling media above 41 degrees C (105 degrees F).
 - 8. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
 - 9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
 - 10. Thermal conductance: Heat flow rate through materials.
 - a. Flat surface: Watt per square meter (BTU per hour per square foot).
 - b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).
 - 11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).

12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.
13. HPS: High pressure steam (415 kPa [60 psig] and above).
14. HPR: High pressure steam condensate return.
15. MPS: Medium pressure steam (110 kPa [16 psig] thru 414 kPa [59 psig]).
16. MPR: Medium pressure steam condensate return.
17. LPS: Low pressure steam (103 kPa [15 psig] and below).
18. LPR: Low pressure steam condensate gravity return.
19. PC: Pumped condensate.
20. HWH: Hot water heating supply.
21. HWHR: Hot water heating return.
22. GH: Hot glycol-water heating supply.
23. GHR: Hot glycol-water heating return.
24. FWPD: Feedwater pump discharge.
25. FWPS: Feedwater pump suction.
26. CTPD: Condensate transfer pump discharge.
27. CTPS: Condensate transfer pump suction.
28. VR: Vacuum condensate return.
29. CPD: Condensate pump discharge.
30. R: Pump recirculation.
31. FOS: Fuel oil supply.
32. FOR: Fuel oil return.
33. CW: Cold water.
34. SW: Soft water.
35. HW: Hot water.
36. CH: Chilled water supply.
37. CHR: Chilled water return.
38. GC: Chilled glycol-water supply.
39. GCR: Chilled glycol-water return.
40. RS: Refrigerant suction.
41. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

- A. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- C. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT
- D. Section 23 21 13, HYDRONIC PIPING and Section 23 22 13, STEAM and CONDENSATE HEATING PIPING: Piping and equipment.
- E. Section 23 21 13, HYDRONIC PIPING: Hot water, chilled water, and glycol piping.
- F. Section 23 31 00, HVAC DUCTS AND CASINGS: Ductwork, plenum and fittings.
- G. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS. Requirements for commissioning, systems readiness checklists, and training.

1.3 QUALITY ASSURANCE

- A. Refer to article QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

- B. Criteria:

- 1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

4.3.3.1 Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems, unless otherwise provided for in 4.3.3.1.1 or 4.3.3.1.2., shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.

4.3.3.1.1 Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

4.3.3.1.2 The flame spread and smoke developed index requirements of 4.3.3.1.1 shall not apply to air duct weatherproof coverings where they are located entirely outside of a building, do not penetrate a wall or roof, and do not create an exposure hazard.

4.3.3.2 Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, Standard for Safety Factory-

Made Air Ducts and Air Connectors, shall have been tested, listed, and used in accordance with the conditions of their listings, in accordance with one of the following:

(1) UL 181A, Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors

(2) UL 181B, Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors

4.3.3.3 Air duct, panel, and plenum coverings and linings, and pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).

4.3.3.4 Air duct coverings shall not extend through walls or floors that are required to be fire stopped or required to have a fire resistance rating, unless such coverings meet the requirements of 5.4.6.4.

4.3.3.5* Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.

4.3.3.6 Air duct coverings shall not be installed so as to conceal or prevent the use of any service opening.

4.3.10.2.6 Materials exposed to the airflow shall be noncombustible or limited combustible and have a maximum smoke developed index of 50 or comply with the following.

4.3.10.2.6.1 Electrical wires and cables and optical fiber cables shall be listed as noncombustible or limited combustible and have a maximum smoke developed index of 50 or shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

4.3.10.2.6.2 Pneumatic tubing for control systems shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1820, Standard for Safety Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics.

4.3.10.2.6.4 Optical-fiber and communication raceways shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2024, Standard for Safety Optical-Fiber Cable Raceway.

4.3.10.2.6.6 Supplementary materials for air distribution systems shall be permitted when complying with the provisions of 4.3.3.

5.4.6.4 Where air ducts pass through walls, floors, or partitions that are required to have a fire resistance rating and where fire

dampers are not required, the opening in the construction around the air duct shall be as follows:

(1) Not exceeding a 25.4 mm (1 in.) average clearance on all sides

(2) Filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the time-temperature fire conditions required for fire barrier penetration as specified in NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*

2. Test methods: ASTM E84, UL 723, or NFPA 255.

3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.

4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.

a. Insulation materials: Specify each type used and state surface burning characteristics.

b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.

c. Insulation accessory materials: Each type used.

- d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
- e. Make reference to applicable specification paragraph numbers for coordination.

C. Samples:

- 1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/ blanket; 150 mm (6 inches) long, full diameter for round types.
- 2. Each type of facing and jacket: Minimum size 100 mm (4 inches square).
- 3. Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives / cement / mastic.

1.5 STORAGE AND HANDLING OF MATERIAL

Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
L-P-535E (2)- 99.....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.
- C. Military Specifications (Mil. Spec.):
MIL-A-3316C (2)-90.....Adhesives, Fire-Resistant, Thermal Insulation
MIL-A-24179A (1)-87.....Adhesive, Flexible Unicellular-Plastic Thermal Insulation
MIL-C-19565C (1)-88.....Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
MIL-C-20079H-87.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass
- D. American Society for Testing and Materials (ASTM):
A167-99(2004).....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B209-07.....	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C411-05.....	Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation
C449-07.....	Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
C533-09.....	Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
C534-08.....	Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
C547-07.....	Standard Specification for Mineral Fiber pipe Insulation
C552-07.....	Standard Specification for Cellular Glass Thermal Insulation
C553-08.....	Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
C585-09.....	Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System) R (1998)
C612-10.....	Standard Specification for Mineral Fiber Block and Board Thermal Insulation
C1126-04.....	Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
C1136-10.....	Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
D1668-97a (2006).....	Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
E84-10.....	Standard Test Method for Surface Burning Characteristics of Building Materials
E119-09c.....	Standard Test Method for Fire Tests of Building Construction and Materials

- E136-09b.....Standard Test Methods for Behavior of Materials
in a Vertical Tube Furnace at 750 degrees C
(1380 F)
- E. National Fire Protection Association (NFPA):
- 90A-09.....Standard for the Installation of Air
Conditioning and Ventilating Systems
- 96-08.....Standards for Ventilation Control and Fire
Protection of Commercial Cooking Operations
- 101-09.....Life Safety Code
- 251-06.....Standard methods of Tests of Fire Endurance of
Building Construction Materials
- 255-06.....Standard Method of tests of Surface Burning
Characteristics of Building Materials
- F. Underwriters Laboratories, Inc (UL):
- 723.....UL Standard for Safety Test for Surface Burning
Characteristics of Building Materials with
Revision of 09/08
- G. Manufacturer's Standardization Society of the Valve and Fitting
Industry (MSS):
- SP58-2009.....Pipe Hangers and Supports Materials, Design,
and Manufacture

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

- A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m³ (3 pcf), k = 0.037 (0.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.
- B. ASTM C553 (Blanket, Flexible) Type I, Class B-3, Density 16 kg/m³ (1 pcf), k = 0.045 (0.31) at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.
- C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

2.2 MINERAL WOOL OR REFRACTORY FIBER

- A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

2.3 RIGID CELLULAR PHENOLIC FOAM

- A. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, $k = 0.021(0.15)$ at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.
- B. Equipment and Duct Insulation, ASTM C 1126, type II, grade 1, $k = 0.021(0.15)$ at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket.

2.4 CELLULAR GLASS CLOSED-CELL

- A. Comply with Standard ASTM C177, C518, density 120 kg/m³ (7.5 pcf) nominal, $k = 0.033(0.29)$ at 24~~0~~ degrees C (75 degrees F).
- B. Pipe insulation for use at temperatures up to 200 degrees C (400 degrees F) with all service vapor retarder jacket.

2.5 POLYISOCYANURATE CLOSED-CELL RIGID

- A. Preformed (fabricated) pipe insulation, ASTM C591, type IV, $K=0.027(0.19)$ at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for use at temperatures up to 149 degree C (300 degree F) with factory applied PVDC or all service vapor retarder jacket with polyvinyl chloride premolded fitting covers.
- B. Equipment and duct insulation, ASTM C 591, type IV, $K=0.027(0.19)$ at 24 degrees C (75 degrees F), for use at temperatures up to 149 degrees C (300 degrees F) with PVDC or all service jacket vapor retarder jacket.

2.6 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

ASTM C177, C518, $k = 0.039(0.27)$ at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

2.7 CALCIUM SILICATE

- A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- C. Equipment Insulation: ASTM C533, Type I and Type II
- D. Characteristics:

Insulation Characteristics		
ITEMS	TYPE I	TYPE II
Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m ³ (lb/ ft ³)	232 (14.5)	288 (18)
Thermal conductivity: Min W/ m K (Btu in/h ft ² degrees F)@ mean temperature of 93 degrees C (200 degrees F)	0.059 (0.41)	0.078 (0.540)
Surface burning characteristics:		
Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

2.8 INSULATION FACINGS AND JACKETS

- A. Vapor Retarder, higher strength with low water permeance ≤ 0.02 or less perm rating, Beach puncture 50 units for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.
- B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.
- D. Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping and ductwork as well as on interior piping and ductwork exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity areas conveying fluids below ambient

temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

- E. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.
- F. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.
- G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.
- H. Aluminum Jacket-Piping systems: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.6 mm (0.024) inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands shall be installed on all circumferential joints. Bands shall be 13 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

2.9 REMOVABLE INSULATION JACKETS

- A. Insulation and Jacket:
 - 1. Non-Asbestos Glass mat, type E needled fiber.
 - 2. Temperature maximum of 450°F, Maximum water vapor transmission of 0.00 perm, and maximum moisture absorption of 0.2 percent by volume.
 - 3. Jacket Material: Silicon/fiberglass and LFP 2109 pure PTFE.
 - 4. Construction: One piece jacket body with three-ply braided pure Teflon or Kevlar thread and insulation sewn as part of jacket. Belt fastened.

2.10 PIPE COVERING PROTECTION SADDLES

- A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as

adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

2.11 ADHESIVE, MASTIC, CEMENT

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
- C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
- E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
- F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- G. Other: Insulation manufacturers' published recommendations.

2.12 MECHANICAL FASTENERS

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching galvanized steel.
- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.

- D. Bands: 13 mm (0.5 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.13 REINFORCEMENT AND FINISHES

- A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
- E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
- F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

2.14 FIRESTOPPING MATERIAL

Other than pipe and duct insulation, refer to Section 07 84 00
FIRESTOPPING.

2.15 FLAME AND SMOKE

Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Required pressure tests of duct and piping joints and connections shall be completed and the work approved by the Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.

- C. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor retarder over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).
- D. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.
- E. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- F. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- G. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- H. HVAC work not to be insulated:
 - 1. Internally insulated ductwork and air handling units.
 - 2. Relief air ducts (Economizer cycle exhaust air).
 - 3. Exhaust air ducts and plenums, and ventilation exhaust air shafts.
 - 4. In hot piping: Unions, flexible connectors, control valves, safety valves and discharge vent piping, vacuum breakers, thermostatic vent valves, steam traps 20 mm (3/4 inch) and smaller, exposed piping through floor for convectors and radiators. Insulate piping to within approximately 75 mm (3 inches) of uninsulated items.

- I. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
- J. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.
- K. Firestop Pipe and Duct insulation:
 - 1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
 - 2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
 - a. Pipe risers through floors
 - b. Pipe or duct chase walls and floors
 - c. Smoke partitions
 - d. Fire partitions
- L. Freeze protection of above grade outdoor piping (over heat tracing tape): 26 mm (10 inch) thick insulation, for all pipe sizes 75 mm(3 inches) and smaller and 25 mm(1inch) thick insulation for larger pipes. Provide metal jackets for all pipes. Provide for cold water make-up to cooling towers and condenser water piping and chilled water piping as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).
- M. Provide vapor barrier jackets over insulation as follows:
 - 1. All piping and ductwork exposed to outdoor weather.
- N. Provide metal jackets over insulation as follows:
 - 1. All piping and ducts exposed to outdoor weather.
 - 2. Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
 - 3. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

3.2 INSULATION INSTALLATION

- A. Mineral Fiber Board:

1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
2. Plain board:
 - a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
 - b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.
 - c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
 - d. Chilled water pumps: Insulate with removable and replaceable 1 mm thick (20 gage) aluminum or galvanized steel covers lined with insulation. Seal closure joints/flanges of covers with gasket material. Fill void space in enclosure with flexible mineral fiber insulation.
3. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics, interstitial spaces and duct work exposed to outdoor weather:
 - a. 50 mm (2 inch) thick insulation faced with ASJ (white all service jacket): Supply air duct.
 - b. 50 mm (2 inch) thick insulation faced with ASJ: Return air duct, mixed air plenums and prefilter housing.
 - c. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a reinforcing membrane and two coats of vapor barrier mastic or multi-layer

vapor barrier with a maximum water vapor permeability of 0.001 perms.

B. Flexible Mineral Fiber Blanket:

1. Adhere insulation to metal with 75 mm (3 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
3. Concealed supply air ductwork.
 - a. Above ceilings at a roof level, in attics, and duct work exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with FSK.
 - b. Above ceilings for other than roof level: 40 mm (1 ½ inch) thick insulation faced with FSK.
4. Concealed return air duct:
 - a. Above ceilings at a roof level, unconditioned areas, and in chases with external wall or containing steam piping: 40 mm (1-1/2 inch) thick, insulation faced with FSK.
 - b. In interstitial spaces (where not subject to damage): 40 mm (1-1/2 inch thick insulation faced with FSK.
 - c. Concealed return air ductwork in other locations need not be insulated.
5. Concealed outside air duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.
6. Exhaust air branch duct from autopsy refrigerator to main duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.

C. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
 - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
 - b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
 - c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
 - d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

D. Rigid Cellular Phenolic Foam:

1. Rigid closed cell phenolic insulation may be provided for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
2. Note the NFPA 90A burning characteristics requirements of 25/50 in paragraph 1.3.B
3. Provide secure attachment facilities such as welding pins.
4. Apply insulation with joints tightly drawn together
5. Apply adhesives, coverings, neatly finished at fittings, and valves.

6. Final installation shall be smooth, tight, neatly finished at all edges.
7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
8. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a maximum water vapor permeance of 0.00 perms.
9. Condensation control insulation: Minimum 25 mm (1.0 inch) thick for all pipe sizes.
 - a. HVAC: Cooling coil condensation piping to waste piping fixture or drain inlet. Omit insulation on plastic piping in mechanical rooms.

E. Cellular Glass Insulation:

1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.
2. Underground Piping Other than or in lieu of that Specified in Section 23 21 13, HYDRONIC PIPING and Section 33 63 00, STEAM ENERGY DISTRIBUTION: Type II, factory jacketed with a 3 mm laminate jacketing consisting of 3000 mm x 3000 mm (10 ft x 10 ft) asphalt impregnated glass fabric, bituminous mastic and outside protective plastic film.
 - a. 75 mm (3 inches) thick for hot water piping.
 - b. As scheduled at the end of this section for chilled water piping.
 - c. Underground piping: Apply insulation with joints tightly butted. Seal longitudinal self-sealing lap. Use field fabricated or factory made fittings. Seal butt joints and fitting with jacketing as recommended by the insulation manufacturer. Use 100 mm (4 inch) wide strips to seal butt joints.
 - d. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.
 - e. Underground insulation shall be inspected and approved by the Resident Engineer as follows:
 - 1) Insulation in place before coating.
 - 2) After coating.
 - f. Sand bed and backfill: Minimum 75 mm (3 inches) all around insulated pipe or tank, applied after coating has dried.
3. Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ for chilled water pumps, water filters, chemical feeder pots or tanks, expansion tanks, air separators and air purgers.

4. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a reinforcing membrane and two coats of vapor barrier mastic or multi-layer vapor barrier with a water vapor permeability of 0.00 perms.

F. Flexible Elastomeric Cellular Thermal Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
2. Pipe and tubing insulation:
 - a. Use proper size material. Do not stretch or strain insulation.
 - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 23 05 11, COMMON WORK RESULTS FOR HVAC
 - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.
5. Minimum 20 mm (0.75 inch) thick insulation for pneumatic control lines for a minimum distance of 6 m (20 feet) from discharge side of the refrigerated dryer.
6. Use Class S (Sheet), 20 mm (3/4 inch) thick for the following:
 - a. Chilled water pumps
 - b. Bottom and sides of metal basins for winterized cooling towers (where basin water is heated).
 - c. Chillers, insulate any cold chiller surfaces subject to condensation which has not been factory insulated.
 - d. Piping inside refrigerators and freezers: Provide heat tape under insulation.

7. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a water vapor permeance of 0.00 perms.

G. Calcium Silicate:

1. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section for piping other than in boiler plant. See paragraphs 3.3 through 3.7 for Boiler Plant Applications.
2. Engine Exhaust Insulation for Emergency Generator and Diesel Driven Fire Pump: Type II, Class D, 65 mm (2 1/2 inch) nominal thickness. Cover exhaust completely from engine through roof or wall construction, including muffler. Secure with 16 AWG galvanized annealed wire or 0.38 x 12 mm 0.015 x 1/2 IN wide galvanized bands on 300 mm 12 IN maximum centers. Anchor wire and bands to welded pins, clips or angles. Apply 25 mm 1 IN hex galvanized wire over insulation. Fill voids with 6 mm 1/4 IN insulating cement.
3. ETO Exhaust (High Temperature): Type II, class D, 65 mm (2.5 inches) nominal thickness. Cover duct for entire length. Provide sheet aluminum jacket for all exterior ductwork.
4. MRI Quench Vent Insulation: Type I, class D, 150 mm (6 inch) nominal thickness.

3.8 PIPE INSULATION SCHEDULE

Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 - 32 (1 - 1¼)	38 - 75 (1½ - 3)	100 (4) and Above
122-177 degrees C (251-350 degrees F) (HPS, MPS)	Mineral Fiber (Above ground piping only)	75 (3)	100 (4)	113 (4.5)	113 (4.5)
93-260 degrees C (200-500 degrees F) (HPS, HPR)	Calcium Silicate	100 (4)	125 (5)	150 (6)	150 (6)
100-121 degrees C	Mineral Fiber (Above ground	62	62 (2.5)	75 (3.0)	75 (3.0)

(212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)	piping only)	(2.5)			
100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)	Rigid Cellular Phenolic Foam	50 (2.0)	50 (2.0)	75 (3.0)	75 (3.0)
38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-99 degrees C (100-211 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
39-99 degrees C (100-211 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Polyiso- cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	----	----
38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	----
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
4-16 degrees C (40-60 degrees F) (CH and CHR within chiller room and pipe chase and	Cellular Glass Closed- Cell	50 (2.0)	50 (2.0)	75 (3.0)	75 (3.0)

underground)					
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Cellular Glass Closed- Cell	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
4-16 degrees C (40-60 degrees F) (CH, CHR, GC and GCR (where underground)	Polyiso- cyanurate Closed-Cell Rigid	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Polyiso- cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
(40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

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SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Ductwork and accessories for HVAC including the following:
 - 1. Supply air, return air, outside air, exhaust, make-up air, and relief systems.
- B. Definitions:
 - 1. SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.
 - 2. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
 - 3. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.2 RELATED WORK

- A. Fire Stopping Material: Section 07 84 00, FIRESTOPPING.
- B. General Mechanical Requirements: Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- C. Noise Level Requirements: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- D. Duct Insulation: Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION

1.3 QUALITY ASSURANCE

- A. Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Fire Safety Code: Comply with NFPA 90A.
- C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.
- D. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown on the drawings.
- E. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Rectangular ducts:
 - a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.
 - b. Duct liner.
 - c. Sealants and gaskets.
 - d. Access doors.
 - 2. Round and flat oval duct construction details:
 - a. Manufacturer's details for duct fittings.
 - b. Duct liner.
 - c. Sealants and gaskets.
 - d. Access sections.
 - e. Installation instructions.
 - 3. Volume dampers, back draft dampers.
 - 4. Upper hanger attachments.
 - 5. Fire dampers, fire doors, and smoke dampers with installation instructions.
 - 6. Sound attenuators, including pressure drop and acoustic performance.
 - 7. Flexible ducts and clamps, with manufacturer's installation instructions.
 - 8. Flexible connections.
 - 9. Instrument test fittings.
 - 10. Details and design analysis of alternate or optional duct systems.
 - 11. COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11 - Common Work Results for HVAC and Steam Generation.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Civil Engineers (ASCE):
 - ASCE7-05.....Minimum Design Loads for Buildings and Other Structures
- C. American Society for Testing and Materials (ASTM):

- A167-99(2009).....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- A653-09.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process
- A1011-09a.....Standard Specification for Steel, Sheet and Strip, Hot rolled, Carbon, structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- B209-07.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- C1071-05e1.....Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
- E84-09a.....Standard Test Method for Surface Burning Characteristics of Building Materials
- D. National Fire Protection Association (NFPA):
- 90A-09.....Standard for the Installation of Air Conditioning and Ventilating Systems
- 96-08.....Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
- 2nd Edition - 2005.....HVAC Duct Construction Standards, Metal and Flexible
- 1st Edition - 1985.....HVAC Air Duct Leakage Test Manual
- 6th Edition - 2003.....Fibrous Glass Duct Construction Standards
- F. Underwriters Laboratories, Inc. (UL):
- 181-08.....Factory-Made Air Ducts and Air Connectors
- 555-06Standard for Fire Dampers
- 555S-06Standard for Smoke Dampers

PART 2 - PRODUCTS

2.0 GENERAL REQUIREMENTS

- A. Regardless of the requirements outlined in the SMACNA Standards, provide minimum 22 gage sheet metal for straight ducts and minimum 20 gage sheet metal for fittings and elbows.
- B. Provide rigid sheet metal ductwork when penetrating the interstitial floor. Penetration with flexible ductwork shall not be permitted.

2.1 DUCT MATERIALS AND SEALANTS

- A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.
- B. Specified Corrosion Resistant Systems: Stainless steel sheet, ASTM A167, Class 302 or 304, Condition A (annealed) Finish No. 4 for exposed ducts and Finish No. 2B for concealed duct or ducts located in mechanical rooms.
- C. Optional Duct Materials:
- D. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, paragraph S1.9.
 - 1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.
 - 2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
 - 3. Gaskets in Flanged Joints: Soft neoprene.
- E. Approved factory made joints may be used.

2.2 DUCT CONSTRUCTION AND INSTALLATION

- A. Regardless of the pressure classifications outlined in the SMACNA Standards, fabricate and seal the ductwork in accordance with the following pressure classifications:
- B. Duct Pressure Classification:
 - 0 to 50 mm (2 inch)
 - > 50 mm to 75 mm (2 inch to 3 inch)
 - > 75 mm to 100 mm (3 inch to 4 inch)
 Show pressure classifications on the floor plans.
- C. Seal Class: All ductwork shall receive Class A Seal
- D. Wet Air Exhaust Ducts and Accessories: Ducts for dishwashers, scullery hood, cart washers, manual cart washers, cage washers, steam sterilizer hoods and orthotics hoods shall be 1.3 mm (18 gage) stainless steel made liquid tight with continuous external weld for all seams and joints. Provide neoprene gaskets at flanged connections. Where ducts are not self draining back to the equipment, provide low point drain pocket with

copper drain pipe to sanitary sewer. Provide access door in side of duct at drain pockets.

- E. Duct for Negative Pressure Up to 750 Pa (3 inch W.G.): Provide for exhaust duct between HEPA filters and exhaust fan inlet including systems for Autopsy Suite exhaust.
 - 1. Round Duct: Galvanized steel, spiral lock seam construction with standard slip joints.
 - 2. Rectangular Duct: Galvanized steel, minimum 1.0 mm (20 gage), Pittsburgh lock seam, companion angle joints 32 mm by 3.2 mm (1-1/4 by 1/8 inch) minimum at not more than 2.4 m (8 feet) spacing. Approved pre-manufactured joints are acceptable in lieu of companion angles.
- F. Round and Flat Oval Ducts: Furnish duct and fittings made by the same manufacturer to insure good fit of slip joints. When submitted and approved in advance, round and flat oval duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown on the drawings.
 - 1. Elbows: Diameters 80 through 200 mm (3 through 8 inches) shall be two sections die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
 - 2. Provide bell mouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA HVAC Duct Construction Standards.
 - 3. Ribbed Duct Option: Lighter gage round/oval duct and fittings may be furnished provided certified tests indicating that the rigidity and performance is equivalent to SMACNA standard gage ducts are submitted.
 - a. Ducts: Manufacturer's published standard gage, G90 coating, spiral lock seam construction with an intermediate standing rib.
 - b. Fittings: May be manufacturer's standard as shown in published catalogs, fabricated by spot welding and bonding with neoprene base cement or machine formed seam in lieu of continuous welded seams.
 - 4. Provide flat side reinforcement of oval ducts as recommended by the manufacturer and SMACNA HVAC Duct Construction Standard S3.13. Because of high pressure loss, do not use internal tie-rod reinforcement unless approved by the Resident Engineer.

- G. VA Type A and B Canopy Hoods, Reagent Grade Water Treatment Room and Battery Charging Room Exhausts: Constructed of 1.3 mm (18 gage) stainless steel.
- H. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches) wide by 1200 - 1350 mm (48 - 54 inches) high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.
- I. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA Detail Figure 2-12 for Single Blade and Figure 2.13 for Multi-blade Volume Dampers.
- J. Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct.
- K. Ductwork in excess of 620 cm² (96 square inches) shall be protected unless the duct has one dimension less than 150 mm (6 inches) if it passes through the areas listed below. Refer to the Mission Critical Physical Design Manual for VA Facilities. This applies to the following:
 - 1. Agent cashier spaces
 - 2. Perimeter partitions of caches
 - 3. Perimeter partitions of computer rooms
 - 4. Perimeter of a COOP sites
 - 5. Perimeter partitions of Entrances
 - 6. Security control centers (SCC)

2.3 DUCT ACCESS DOORS, PANELS AND SECTIONS

- A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:
 - 1. Each duct mounted coil and humidifier.
 - 2. Each fire damper (for link service), smoke damper and automatic control damper.
 - 3. Each duct mounted smoke detector.
 - 4. For cleaning operating room supply air duct and kitchen hood exhaust duct, locate access doors at 6 m (20 feet) intervals and at each change in duct direction.
- B. Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12 inch) minimum where possible. Access sections in

insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.

1. For rectangular ducts: Refer to SMACNA HVAC Duct Construction Standards (Figure 2-12).
2. For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure 2-11).

2.4 FIRE DAMPERS

- A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2 hour rating, 70 degrees C (160 degrees F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.
- B. Fire dampers in wet air exhaust shall be of stainless steel construction, all others may be galvanized steel.
- C. Minimum requirements for fire dampers:
 1. The damper frame may be of design and length as to function as the mounting sleeve, thus eliminating the need for a separate sleeve, as allowed by UL 555. Otherwise provide sleeves and mounting angles, minimum 1.9 mm (14 gage), required to provide installation equivalent to the damper manufacturer's UL test installation.
 2. Submit manufacturer's installation instructions conforming to UL rating test.

2.5 SMOKE DAMPERS

- A. Maximum air velocity, through free area of open damper, and pressure loss: Low pressure and medium pressure duct (supply, return, exhaust, outside air): 450 m/min (1500 fpm). Maximum static pressure loss: 32 Pa (0.13 inch W.G.).
- B. Maximum air leakage, closed damper: 0.32 cubic meters /min/square meter (4.0 CFM per square foot) at 750 Pa (3 inch W.G.) differential pressure.
- C. Minimum requirements for dampers:
 1. Shall comply with requirements of Table 6-1 of UL 555S, except for the Fire Endurance and Hose Stream Test.
 2. Frame: Galvanized steel channel with side, top and bottom stops or seals.
 3. Blades: Galvanized steel, parallel type preferably, 300 mm (12 inch) maximum width, edges sealed with neoprene, rubber or felt, if required to meet minimum leakage. Airfoil (streamlined) type for minimum noise generation and pressure drop are preferred for duct mounted dampers.
 4. Shafts: Galvanized steel.
 5. Bearings: Nylon, bronze sleeve or ball type.

6. Hardware: Zinc plated.

7. Operation: Automatic open/close. No smoke damper that requires manual reset or link replacement after actuation is acceptable. See drawings for required control operation.

D. Motor operator (actuator): Provide pneumatic or electric as required by the automatic control system, externally mounted on stand-offs to allow complete insulation coverage.

2.6 COMBINATION FIRE AND SMOKE DAMPERS

Combination fire and smoke dampers: Multi-blade type units meeting all requirements of both fire dampers and smoke dampers shall be used where shown and may be used at the Contractor's option where applicable.

2.7 FIRE DOORS

Galvanized steel, interlocking blade type, UL listing and label, 71 degrees C (160 degrees F) fusible link, 3 hour rating and approved for openings in Class A fire walls with rating up to 4 hours, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

2.8 FLEXIBLE AIR DUCT

A. General: Factory fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m (5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.

B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts larger than 200 mm (8 inches) in diameter shall be Class 1. Ducts 200 mm (8 inches) in diameter and smaller may be Class 1 or Class 2.

C. Insulated Flexible Air Duct: Factory made including mineral fiber insulation with maximum C factor of 0.25 at 24 degrees C (75 degrees F) mean temperature, encased with a low permeability moisture barrier outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall not be less than 3 dB per 300 mm (foot) of straight duct, at 500 Hz, based on 150 mm (6 inch) duct, of 750 m/min (2500 fpm).

D. Application Criteria:

1. Temperature range: -18 to 93 degrees C (0 to 200 degrees F) internal.
2. Maximum working velocity: 1200 m/min (4000 feet per minute).
3. Minimum working pressure, inches of water gage: 2500 Pa (10 inches) positive, 500 Pa (2 inches) negative.

- E. Duct Clamps: 100 percent nylon strap, 80 kg (175 pounds) minimum loop tensile strength manufactured for this purpose or stainless steel strap with cadmium plated worm gear tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

2.9 FLEXIBLE DUCT CONNECTIONS

Where duct connections are made to fans, air terminal units, and air handling units, install a non-combustible flexible connection of 822 g (29 ounce) neoprene coated fiberglass fabric approximately 150 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to insure that no vibration is transmitted.

2.10 SOUND ATTENUATING UNITS

- A. Casing, not less than 1.0 mm (20 gage) galvanized sheet steel, or 1.3 mm (18 gage) aluminum fitted with suitable flanges to make clean airtight connections to ductwork. Sound-absorbent material faced with glass fiber cloth and covered with not less than 0,6 mm (24 gage) or heavier galvanized perforated sheet steel, or 0.85 mm (22 gage) or heavier perforated aluminum. Perforations shall not exceed 4 mm (5/32-inch) diameter, approximately 25 percent free area. Sound absorbent material shall be long glass fiber acoustic blanket meeting requirements of NFPA 90A.
- B. Entire unit shall be completely air tight and free of vibration and buckling at internal static pressures up to 2000 Pa (8 inches W.G.) at operating velocities.
- C. Pressure drop through each unit: Not to exceed indicated value at design air quantities indicated.
- D. Submit complete independent laboratory test data showing pressure drop and acoustical performance.
- E. Cap open ends of attenuators at factory with plastic, heavy duty paper, cardboard, or other appropriate material to prevent entrance of dirt, water, or any other foreign matter to inside of attenuator. Caps shall not be removed until attenuator is installed in duct system.

2.11 FIRESTOPPING MATERIAL

Refer to Section 07 84 00, FIRESTOPPING.

2.12 INSTRUMENT TEST FITTINGS

- A. Manufactured type with a minimum 50 mm (two inch) length for insulated duct, and a minimum 25 mm (one inch) length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.
- B. Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and at entering and leaving side of each heating coil, cooling coil, and heat recovery unit.

2.13 AIR FLOW CONTROL VALVES (AFCV)

Refer to Section 23 36 00 / 23 82 00, AIR TERMINAL UNITS / CONVECTION HEATING and COOLING UNITS.

2.14 LEAD COVERED DUCT

- A. Sheet Lead: 3.1 mm (1/8 inch) thick, securely installed, free of waves, lumps or wrinkles and with as few joints as possible.
- B. Joints shall be made to obtain X-ray absorption equivalent to adjacent sheet lead, and finished smooth and neat.

2.15 ELECTROSTATIC SHIELDING

- A. At the point of penetration of shielded rooms ducts shall be made electrically discontinuous by means of a flexible, nonconductive connection outside shielded room.
- B. Metallic duct portion inside shielded room shall be electrically bonded to shielding.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION, particularly regarding coordination with other trades and work in existing buildings.
- B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:
 - 1. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions

- with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
 3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards.
 4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Chapter 6. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.
- C. Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.
- D. Install fire dampers, smoke dampers and combination fire/smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install fire dampers, smoke dampers and combination fire/smoke dampers at locations indicated and where ducts penetrate fire rated and/or smoke rated walls, shafts and where required by the Resident Engineer. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges per UL and NFPA. Demonstrate re-setting of fire dampers and operation of smoke dampers to the Resident Engineer.
- E. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.
- F. Flexible duct installation: Refer to SMACNA Standards, Chapter 3. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long (NFPA 90A), as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with clamps as recommended by SMACNA. Clamp per SMACNA with one clamp on the core duct and one on the insulation jacket. Flexible ducts shall not penetrate floors, or any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hour. Support ducts SMACNA Standards.
- G. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.
- H. Control Damper Installation:

1. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.
 2. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.
 3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
 4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.
- I. Air Flow Measuring Devices (AFMD): Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.
- J. Low Pressure Duct Liner: Install in accordance with SMACNA, Duct Liner Application Standard.
- K. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Resident Engineer. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

3.2 DUCT LEAKAGE TESTS AND REPAIR

- A. Ductwork leakage testing shall be performed by the Testing and Balancing Contractor directly contracted by the General Contractor and independent of the Sheet Metal Contractor.
- B. Ductwork leakage testing shall be performed for the entire air distribution system (including all supply, return, exhaust and relief ductwork), section by section, including fans, coils and filter sections. Based upon satisfactory initial duct leakage test results, the scope of the testing may be reduced by the Resident Engineer on ductwork constructed to the 500 Pa (2" WG) duct pressure classification. In no case shall the leakage testing of ductwork constructed above the 500 Pa (2" WG) duct pressure classification or ductwork located in shafts or other inaccessible areas be eliminated.

- C. Test procedure, apparatus and report shall conform to SMACNA Leakage Test manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.
- D. All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.
- E. All tests shall be performed in the presence of the Resident Engineer and the Test and Balance agency. The Test and Balance agency shall measure and record duct leakage and report to the Resident Engineer and identify leakage source with excessive leakage.
- F. If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the Resident Engineer.
- G. All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.
- H. Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

3.4 TESTING, ADJUSTING AND BALANCING (TAB)

Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

3.5 OPERATING AND PERFORMANCE TESTS

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION

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**SECTION 23 37 00
AIR OUTLETS AND INLETS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Roof Curbs
- B. Air Outlets and Inlets: Diffusers, Registers, and Grilles.

1.2 RELATED WORK

- A. Outdoor and Exhaust Louvers: Section 08 90 00, LOUVERS AND VENTS.
- B. Kitchen Hoods: Section 23 38 13, COMMERCIAL-KITCHEN HOODS.
- C. Fume Hoods: Section 11 53 13, LABORATORY FUME HOODS.
- D. Seismic Reinforcing: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- E. General Mechanical Requirements: Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- F. Noise Level Requirements: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- G. Testing and Balancing of Air Flows: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

1.3 QUALITY ASSURANCE

- A. Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- B. Fire Safety Code: Comply with NFPA 90A.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Air intake/exhaust hoods.
 - 2. Diffusers, registers, grilles and accessories.
- C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Diffusion Council Test Code:
 - 1062 GRD-84.....Certification, Rating, and Test Manual 4th Edition
- C. American Society of Civil Engineers (ASCE):

ASCE7-05.....Minimum Design Loads for Buildings and Other
Structures

D. American Society for Testing and Materials (ASTM):

A167-99 (2004).....Standard Specification for Stainless and
Heat-Resisting Chromium-Nickel Steel Plate,
Sheet and Strip

B209-07.....Standard Specification for Aluminum and
Aluminum-Alloy Sheet and Plate

E. National Fire Protection Association (NFPA):

90A-09.....Standard for the Installation of Air
Conditioning and Ventilating Systems

F. Underwriters Laboratories, Inc. (UL):

181-08.....UL Standard for Safety Factory-Made Air Ducts
and Connectors

PART 2 - PRODUCTS

2.1 GRAVITY INTAKE/EXHAUST VENTILATORS (ROOF MOUNTED)

A. Aluminum, ASTM B209, louvered, spun, or fabricated using panel sections with roll-formed edges, 13 mm (1/2 inch) mesh aluminum welded wire bird screen, with gravity or motorized dampers where shown, accessible interior, designed for wind velocity specified in Paragraph 3.3.

1. Spun Intake/Exhaust Ventilators: Spun aluminum structural components shall be constructed of minimum 1.3 mm (16 Gauge) marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The spun aluminum baffle shall have a rolled bead for added strength.
2. Louvered Intake/Exhaust Hoods: Louvered hood constructed from 0.081 Gauge extruded aluminum tiers welded to a minimum 3.3 mm (8 Gauge) aluminum support structure. The aluminum hood shall be constructed of a minimum 0.064 marine alloy aluminum and provided with a layer of anti-condensate coating. The aluminum base shall have continuously welded curb cap corners for maximum leak protection.
3. Low Silhouette Intake/Exhaust Ventilator: The unit shall be of bolted and welded construction utilizing corrosion resistant fasteners. The aluminum hood shall be constructed of minimum 1.60 mm (14 Gauge) marine alloy aluminum, bolted to a minimum 3.25 mm (8 Gauge) aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. Birdscreen constructed of 13 mm (1/2 inch) mesh shall be mounted across the relief opening.

- B. See ventilator schedule on the drawings. Sizes shown on the drawings designate throat size. Area of ventilator perimeter opening shall be not less than the throat area.
- C. Dampers for Gravity Ventilators without Duct Connection: Construct damper of the same material as the ventilator and of the design to completely close opening or remain wide open. Hold damper in closed position by a brass chain and catch. Extend chains 300 mm (12 inches) below and engage catch when damper is closed.
- D. Provide Roof Curb by unit manufacturer. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION for additional requirements.

2.2 EQUIPMENT SUPPORTS

Refer to Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

2.3 AIR OUTLETS AND INLETS

- A. Materials:
 - 1. Steel or aluminum Provide manufacturer's standard gasket.
 - 2. Exposed Fastenings: The same material as the respective inlet or outlet. Fasteners for aluminum may be stainless steel.
 - 3. Contractor shall review all ceiling drawings and details and provide all ceiling mounted devices with appropriate dimensions and trim for the specific locations.
- B. Performance Test Data: In accordance with Air Diffusion Council Code 1062GRD. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT for NC criteria.
- C. Air Supply Outlets:
 - 1. Ceiling Diffusers: Suitable for surface mounting, exposed T-bar or special tile ceilings, off-white finish, square or round neck connection as shown on the drawings. Provide plaster frame for units in plaster ceilings.
 - a. Square, louver, fully adjustable pattern: Round neck, surface mounting unless shown otherwise on the drawings. Provide equalizing or control grid and volume control damper.
 - b. Louver face type: Square or rectangular, removable core for 1, 2, 3, or 4 way directional pattern. Provide equalizing or control grid and opposed blade damper.
 - c. Perforated face type: Manual adjustment for one-, two-, three-, or four-way horizontal air distribution pattern without change of air

volume or pressure. Provide equalizing or control grid and opposed blade over overlapping blade damper. Perforated face diffusers for VAV systems shall have the pattern controller on the inner face, rather than in the neck and designed to discharge air horizontally at the ceiling maintaining a Coanda effect.

4. Supply Registers: Double deflection type with horizontal face bars and opposed blade damper with removable key operator.
 - a. Margin: Flat, 30 mm (1-1/4 inches) wide.
 - b. Bar spacing: 20 mm (3/4 inch) maximum.
 - c. Finish: Off white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded with manufacturer's standard finish.
 5. Supply Grilles: Same as registers but without the opposed blade damper.
- D. Return and Exhaust Registers and Grilles: Provide opposed blade damper without removable key operator for registers.
1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded aluminum with manufacturer's standard aluminum finish.
 2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 30 mm (1-1/4 inch) margin.
 3. Perforated Face Type: To match supply units.
 4. Grid Core Type: 13 mm by 13 mm (1/2 inch by 1/2 inch) core with 30 mm (1-1/4 inch) margin.
 5. Linear Type: To match supply units.
 6. Door Grilles: Are furnished with the doors.
 7. Egg Crate Grilles: Aluminum or Painted Steel 1/2 by 1/2 by 1/2 inch grid providing 90% free area.
 - a. Heavy extruded aluminum frame shall have countersunk screw mounting. Unless otherwise indicated, register blades and frame shall have factory applied white finish.
 - b. Grille shall be suitable for duct or surface mounting as indicated on drawings. All necessary appurtenances shall be provided to allow for mounting.
- E. Supply Registers in Psychiatric Rooms: Supply air registers shall be security type, steel with perforated faceplate, flat surface margin, extension sleeve, opposed blade damper and back mounting flanges. Faceplate shall be 5 mm (3/16 inch) (minimum) with 5x5 mm holes on 7 mm (3/16 by 3/16 inch holes on 9/32 inch) spacing and a minimum free

area of 45 percent. Wall sleeve shall be 5 mm (3/16 inch) thick (minimum).

- F. Air Inlet Registers in Psychiatric Rooms: Return, exhaust, transfer and relief air registers shall be security type, steel with perforated faceplate, flat surface margin, wall sleeve, opposed blade damper and back mounting flanges. Faceplate shall be 5 mm (3/16 inch) (minimum) with 5x5 mm holes on 7 mm (3/16 by 3/16 inch holes on 9/32 inch) spacing and a minimum free area of 45 percent. Wall sleeve shall be 5 mm (3/16 inch) thick (minimum).
- G. Acoustic Transfer Grille: Aluminum, suitable for partition or wall mounting.

2.4 WIRE MESH GRILLE

- A. Fabricate grille with 2 x 2 mesh 13 mm (1/2 inch) galvanized steel or aluminum hardware cloth in a spot welded galvanized steel frame with approximately 40 mm (1-1/2 inch) margin.
- B. Use grilles where shown in unfinished areas such as mechanical rooms.

2.5 FILTER RETURN/EXHAUST GRILLE

- A. Provide grille with in stream 1-inch deep MERV 4 filter and removable face.
 - 1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded aluminum with manufacturer's standard aluminum finish. Stainless Steel shall be No. 4 finish.
 - 2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 30 mm (1-1/4 inch) margin.
 - 3. Steel, Aluminum, or Stainless steel as scheduled.
 - 4. Standard face connected to a mounting frame with space for a throwaway filter. Hold face closed by a locking screw. Provide retaining clips to hold filter in place. Provide fiberglass throwaway filter.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, particularly regarding coordination with other trades and work in existing buildings.
- B. Protection and Cleaning: Protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Resident Engineer. Protect equipment during construction against entry

of foreign matter to the inside and clean both inside and outside before operation and painting.

3.2 TESTING, ADJUSTING AND BALANCING (TAB)

Refer to Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.3 OPERATING AND PERFORMANCE TESTS

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION

- - - E N D - - -

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

- A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.
- B. Section 07 60 00, FLASHING AND SHEET METAL: Fabrications for the deflection of water away from the building envelope at penetrations.
- C. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.
- D. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.
- E. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.
- F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- G. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- H. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground conduits.
- I. Section 31 20 00, EARTH MOVING: Bedding of conduits.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- A. Manufacturer's Literature and Data: Showing each cable type and rating. The specific item proposed and its area of application shall be identified on the catalog cuts.

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American National Standards Institute (ANSI):

- C80.1-05.....Electrical Rigid Steel Conduit
- C80.3-05.....Steel Electrical Metal Tubing
- C80.6-05.....Electrical Intermediate Metal Conduit

C. National Fire Protection Association (NFPA):

- 70-08.....National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

- 1-05.....Flexible Metal Conduit
- 5-04.....Surface Metal Raceway and Fittings
- 6-07.....Electrical Rigid Metal Conduit - Steel
- 50-95.....Enclosures for Electrical Equipment
- 360-093.....Liquid-Tight Flexible Steel Conduit
- 467-07.....Grounding and Bonding Equipment
- 514A-04.....Metallic Outlet Boxes
- 514B-04.....Conduit, Tubing, and Cable Fittings
- 514C-96.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
- 651-05.....Schedule 40 and 80 Rigid PVC Conduit and Fittings
- 651A-00.....Type EB and A Rigid PVC Conduit and HDPE Conduit
- 797-07.....Electrical Metallic Tubing
- 1242-06.....Electrical Intermediate Metal Conduit - Steel

E. National Electrical Manufacturers Association (NEMA):

- TC-2-03.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and
Tubing

FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies
for Conduit, Electrical Metallic Tubing and
Cable

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Conduit Size: In accordance with the NEC, but not less than 3/4" unless otherwise shown. Where permitted by the NEC, a minimum 3/4" flexible conduit may be used for tap connections to recessed lighting fixtures.
- B. Conduit:
 - 1. Rigid steel: Shall conform to UL 6 and ANSI C80.1.
 - 2. Rigid intermediate steel conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
 - 3. Electrical metallic tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 4 in [105 mm] and shall be permitted only with cable rated 600 V or less.
 - 4. Flexible galvanized steel conduit: Shall conform to UL 1.
 - 5. Liquid-tight flexible metal conduit: Shall conform to UL 360.
 - 6. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
 - 7. Surface metal raceway: Shall conform to UL 5.
 - 8. No BX conduit shall be allowed in the facility.
- C. All conduit Fittings shall be compression unless noted otherwise.
- D. Conduit Supports:
 - 1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
 - 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
 - 3. Multiple conduit (trapeze) hangers: Not less than 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] diameter steel hanger rods.
 - 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- E. Outlet, Junction, and Pull Boxes:
 - 1. UL-50 and UL-514A.
 - 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
 - 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.

4. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

F. Wireways: Equip with hinged covers, except where removable covers are shown. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the Resident Engineer prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the Resident Engineer as required by limited working space.

B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight, as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

- A. In accordance with UL, NEC, as shown, and as specified herein.
- B. Essential (Emergency) raceway systems shall be entirely independent of other raceway systems.
- C. Install conduit as follows:
 1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
 2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
 3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
 4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.

5. Cut square, ream, remove burrs, and draw up tight.
 6. Independently support conduit at 8 ft [2.4 M] on centers. Do not use other supports, i.e., suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts.
 7. Support within 12 in [300 mm] of changes of direction, and within 12 in [300 mm] of each enclosure to which connected.
 8. Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
 9. Conduit installations under fume and vent hoods are prohibited.
 10. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
 11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
 12. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
- D. Conduit Bends:
1. Make bends with standard conduit bending machines.
 2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
 3. Bending of conduits with a pipe tee or vise is prohibited.
- E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
 2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the Resident Engineer.

3.3 CONCEALED WORK INSTALLATION

- A. In Concrete:
1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
 2. Align and run conduit in direct lines.
 3. Install conduit through concrete beams only:
 - a. Where shown on the structural drawings.
 - b. As approved by the Resident Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

4. Installation of conduit in concrete that is less than 3 in [75 mm] thick is prohibited.
 - a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
 - b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
 - c. Install conduits approximately in the center of the slab so that there will be a minimum of 0.75 in [19 mm] of concrete around the conduits.
 5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.
- B. Above Furred or Suspended Ceilings and in Walls:
1. Conduit for conductors above 600 V: Rigid steel. Mixing different types of conduits indiscriminately in the same system is prohibited.
 2. Conduit for conductors 600 V and below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the same system is prohibited.
 3. Align and run conduit parallel or perpendicular to the building lines.
 4. Connect recessed lighting fixtures to conduit runs with maximum 6 ft [1.8 M] of flexible metal conduit extending from a junction box to the fixture.
 5. Tightening setscrews with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors above 600 V: Rigid steel. Mixing different types of conduits indiscriminately in the system is prohibited.
- C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the system is prohibited.
- D. Align and run conduit parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- F. Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
- G. Surface metal raceways: Use only where shown.
- H. Painting:
 1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.

2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 2 in [50 mm] high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 20 ft [6 M] intervals in between.

3.5 DIRECT BURIAL INSTALLATION

Refer to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

3.6 HAZARDOUS LOCATIONS

- A. Use rigid steel conduit only, notwithstanding requirements otherwise specified in this or other sections of these specifications.
- B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.7 WET OR DAMP LOCATIONS

- A. Unless otherwise shown, use conduits of rigid steel.
- B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.
- C. Unless otherwise shown, use rigid steel within 5 ft [1.5 M] of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

3.8 MOTORS AND VIBRATING EQUIPMENT

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water. Provide a green equipment grounding conductor with flexible metal conduit.

3.9 EXPANSION JOINTS

- A. Conduits 3 in [75 mm] and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

- B. Provide conduits smaller than 3 in [75 mm] with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 in [125 mm] vertical drop midway between the ends. Flexible conduit shall have a bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for conduits 15 in [375 mm] and larger are acceptable.
- C. Install expansion and deflection couplings where shown.

3.10 CONDUIT SUPPORTS, INSTALLATION

- A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 lbs [90 kg]. Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
2. Existing Construction:
 - a. Steel expansion anchors not less than 0.25 in [6 mm] bolt size and not less than 1.125 in [28 mm] embedment.
 - b. Power set fasteners not less than 0.25 in [6 mm] diameter with depth of penetration not less than 3 in [75 mm].
 - c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

E. Hollow Masonry: Toggle bolts.

F. Bolts supported only by plaster or gypsum wallboard are not acceptable.

G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

H. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

I. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

J. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

K. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.11 BOX INSTALLATION

A. Boxes for Concealed Conduits:

1. Flush-mounted.
2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 24 in [600 mm] center-to-center lateral spacing shall be maintained between boxes.

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 in [100 mm] square x 2.125 in [55 mm] deep, with device covers for the wall material and thickness involved.

- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."
- G. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

SECTION 26 05 73
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the overcurrent protective device coordination study, indicated as the study in this section.
- B. A short-circuit and selective coordination study shall be prepared for the electrical overcurrent devices to be installed under this project.
- C. The study shall present a well-coordinated time-current analysis of each overcurrent protective device from the individual device up to the main overcurrent protecting device of the panelboard/switchboard/MCC serving all the individual devices. Overcurrent protective devices shall be coordinated in a manner that an individual device will not trip other individual devices or the main.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 26 23 00, LOW-VOLTAGE SWITCHGEAR: Low-voltage switchgear.
- C. Section 26 24 13, DISTRIBUTION SWITCHBOARDS: Low-voltage distribution switchboards.
- D. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.
- E. Section 26 24 19, MOTOR CONTROL CENTERS: Motor control centers.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. The study shall be prepared by the equipment manufacturer.

1.4 SUBMITTALS

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
 - 1. Product data on the software program to be used for the study. Software shall be in mainstream use in the industry, shall provide device settings and ratings, and shall show selective coordination by time-current drawings.
 - 2. Complete study as described in paragraph 1.6. Submittal of the study shall be well-coordinated with submittals of the shop drawings for equipment in related specification sections.

3. Certifications: Two weeks prior to final inspection, submit the following.

- a. Certification by the Contractor that the overcurrent protective devices have been set in accordance with the approved study.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Institute of Electrical and Electronics Engineers (IEEE):
 - 242-01.....Protection and Coordination of Industrial and Commercial Power Systems
 - 399-97.....Industrial and Commercial Power Systems Analysis
 - 1584a-04.....Guide for Performing Arc-Flash Hazard Calculations

1.6 STUDY REQUIREMENTS

- A. The study shall include one line diagram, short-circuit and ground fault analysis, and protective coordination plots for all overcurrent protective devices.
- B. One Line Diagram:
 - 1. Show all electrical equipment and wiring to be protected by the overcurrent devices.
 - 2. Show the following specific information:
 - a. Calculated fault impedance, X/R ratios, and short-circuit values at each feeder and branch circuit bus.
 - b. Relay, circuit breaker, and fuse ratings.
 - c. Generator kW/kVA and transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 - d. Voltage at each bus.
 - e. Identification of each bus, matching the identification on the drawings.
 - f. Conduit, conductor, and busway material, size, length, and X/R ratios.
- C. Short-Circuit Study:
 - 1. The study shall be performed using computer software designed for this purpose. Pertinent data and the rationale employed in

developing the calculations shall be described in the introductory remarks of the study.

2. Calculate the fault impedance to determine the available short-circuit and ground fault currents at each bus. Incorporate applicable motor and/or generator contribution in determining the momentary and interrupting ratings of the overcurrent protective devices.
3. Present the results of the short-circuit study in a table. Include the following:
 - a. Device identification.
 - b. Operating voltage.
 - c. Overcurrent protective device type and rating.
 - d. Calculated short-circuit current.

D. Coordination Curves:

1. Prepare the coordination curves to determine the required settings of overcurrent protective devices to demonstrate selective coordination. Graphically illustrate on log-log paper that adequate time separation exists between devices, including the utility company upstream device if applicable. Plot the specific time-current characteristics of each overcurrent protective device in such a manner that all devices are clearly depicted.
2. The following specific information shall also be shown on the coordination curves:
 - a. Device identification.
 - b. Potential transformer and current transformer ratios.
 - c. Three-phase and single-phase ANSI damage points or curves for each cable, transformer, or generator.
 - d. Applicable circuit breaker or protective relay characteristic curves.
 - e. No-damage, melting, and clearing curves for fuses.
 - f. Transformer in-rush points.
3. Develop a table to summarize the settings selected for the overcurrent protective devices. Include the following in the table:
 - a. Device identification.
 - b. Protective relay or circuit breaker potential and current transformer ratios, sensor rating, and available and suggested pickup and delay settings for each available trip characteristic.
 - c. Fuse rating and type.

1.7 ANALYSIS

- A. Analyze the short-circuit calculations, and highlight any equipment determined to be underrated as specified. Propose solutions to effectively protect the underrated equipment.

1.8 ADJUSTMENTS, SETTINGS, AND MODIFICATIONS

- A. Final field settings and minor modifications of the overcurrent protective devices shall be made to conform with the study, without additional cost to the Government.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

---END---

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of panelboards.

1.2 RELATED WORK

- A. Section 09 91 00, PAINTING: Painting of panelboards.
- B. Section 25 10 10, ADVANCED UTILITY METERING: Requirements for electrical metering.
- C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- D. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- F. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.
- G. Section 26 09 23, LIGHTING CONTROLS: Lighting controls integral to panelboards.
- H. Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY: Short circuit and coordination study, and requirements for a coordinated electrical system.
- I. Section 26 43 13, SURGE PROTECTIVE DEVICES: Surge protective devices integral to panelboards.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
 - 1. Shop Drawings:
 - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, circuit breakers, wiring and connection diagrams, accessories, and nameplate data.

2. Manuals:

- a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering circuit breakers and replacement parts.
 - 1) Include schematic diagrams, with all terminals identified, matching terminal identification in the panelboards.
 - 2) Include information for testing, repair, troubleshooting, assembly, and disassembly.
 - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
- a. Certification by the manufacturer that the panelboards conform to the requirements of the drawings and specifications.
 - b. Certification by the Contractor that the panelboards have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. International Code Council (ICC):
 - IBC-12.....International Building Code
- C. National Electrical Manufacturers Association (NEMA):
 - PB 1-11.....Panelboards
 - 250-08.....Enclosures for Electrical Equipment (1,000V Maximum)
- D. National Fire Protection Association (NFPA):
 - 70-11.....National Electrical Code (NEC)
 - 70E-12.....Standard for Electrical Safety in the Workplace
- E. Underwriters Laboratories, Inc. (UL):
 - 50-95.....Enclosures for Electrical Equipment
 - 67-09.....Panelboards
 - 489-09.....Molded Case Circuit Breakers and Circuit Breaker Enclosures

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Panelboards shall be in accordance with NEC, NEMA, UL, as specified, and as shown on the drawings.
- B. Panelboards shall have main breaker or main lugs, bus size, voltage, phases, number of circuit breaker mounting spaces, top or bottom feed, flush or surface mounting, branch circuit breakers, and accessories as shown on the drawings.
- C. Panelboards shall be completely factory-assembled with molded case circuit breakers and integral accessories as shown on the drawings or specified herein.
- D. Non-reduced size copper bus bars, rigidly supported on molded insulators, and fabricated for bolt-on type circuit breakers.
- E. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.
- F. Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys listed for use with the conductors to which they will be connected.
- G. Neutral bus shall be 100% rated (unless indicated otherwise), mounted on insulated supports.
- H. Grounding bus bar shall be copper and equipped with screws or lugs for the connection of equipment grounding conductors.
- I. Bus bars shall be copper and braced for the available short-circuit current as shown on the study, but not be less than 10,000 A symmetrical for 120/208 V and 120/240 V panelboards, and 14,000 A symmetrical for 277/480 V panelboards.
- J. In two-section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panelboards, and have field-installed cable connections to the second section as shown on the drawings. Panelboard sections with tapped bus or crossover bus are not acceptable.
- K. Series-rated panelboards are not permitted.

2.2 ENCLOSURES AND TRIMS

- A. Enclosures:
 - 1. Provide galvanized steel enclosures, with NEMA rating as shown on the drawings or as required for the environmental conditions in which installed.

2. Enclosures shall not have ventilating openings.
3. Enclosures may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide manufacturer's standard option for prepunched knockouts on top and bottom endwalls.
5. Include removable inner dead front cover, independent of the panelboard cover.

B. Trims:

1. Hinged "door-in-door" type.
2. Interior hinged door with hand-operated latch or latches, as required to provide access only to circuit breaker operating handles, not to energized parts.
3. Outer hinged door shall be securely mounted to the panelboard enclosure with factory bolts, screws, clips, or other fasteners, requiring a key or tool for entry. Hand-operated latches are not acceptable.
4. Inner and outer doors shall open left to right.
5. Trims shall be flush or surface type as shown on the drawings.

2.3 MOLDED CASE CIRCUIT BREAKERS

- A. Circuit breakers shall be per UL, NEC, as shown on the drawings, and as specified.
- B. Circuit breakers shall be bolt-on type.
- C. Circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:
 1. 120/208 V Panelboard: 10,000 A symmetrical.
 2. 120/240 V Panelboard: 10,000 A symmetrical.
 3. 277/480 V Panelboard: 14,000 A symmetrical.
- D. Circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for less than 400 A frame. Circuit breakers with 400 A frames and above shall have magnetic trip, adjustable from 5x to 10x. Breaker trip setting shall be set in the field, based on the approved protective device study as specified in Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY.
- E. Circuit breaker features shall be as follows:
 1. A rugged, integral housing of molded insulating material.
 2. Silver alloy contacts.
 3. Arc quenchers and phase barriers for each pole.
 4. Quick-make, quick-break, operating mechanisms.

5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
6. Electrically and mechanically trip free.
7. An operating handle which indicates closed, tripped, and open positions.
8. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where shown on the drawings.
10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

2.4 SURGE PROTECTIVE DEVICES

- A. Where shown on the drawings, furnish panelboards with integral surge protective devices. Refer to Section 26 43 13, SURGE PROTECTIVE DEVICES.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected.
- C. Install a printed schedule of circuits in each panelboard after approval by the Resident Engineer. Schedules shall reflect final load descriptions, room numbers, and room names connected to each circuit breaker. Schedules shall be printed on the panelboard directory cards and be installed in the appropriate panelboards
- D. Mount panelboards such that the maximum height of the top circuit breaker above the finished floor shall not exceed 1980 mm (78 inches).
- E. Provide blank cover for each unused circuit breaker mounting space.
- F. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims with finishes to match surrounding surfaces after the panelboards have been installed. Do not paint nameplates.

- G. Rust and scale shall be removed from the inside of existing enclosures where new interior components are to be installed. Paint inside of enclosures with rust-preventive paint before the new interior components are installed. Provide new trim. Trim shall fit tight to the enclosure.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
 - 1. Visual Inspection and Tests:
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Verify appropriate anchorage and required area clearances.
 - d. Verify that circuit breaker sizes and types correspond to approved shop drawings.
 - e. To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.
 - f. Vacuum-clean enclosure interior. Clean enclosure exterior.

3.3 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the panelboards are in good operating condition and properly performing the intended function.

---END---

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.
- C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- E. Section 26 51 00, INTERIOR LIGHTING: Fluorescent ballasts and LED drivers for use with manual dimming controls.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
 - 1. Shop Drawings:
 - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
 - 2. Manuals:
 - a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.

- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
- 3. Certifications: Two weeks prior to final inspection, submit the following.
 - a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
 - b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. National Fire Protection Association (NFPA):
 - 70-11.....National Electrical Code (NEC)
 - 99-12.....Health Care Facilities
- C. National Electrical Manufacturers Association (NEMA):
 - WD 1-10.....General Color Requirements for Wiring Devices
 - WD 6-08Wiring Devices - Dimensional Specifications
- D. Underwriter's Laboratories, Inc. (UL):
 - 5-11.....Surface Metal Raceways and Fittings
 - 20-10.....General-Use Snap Switches
 - 231-07.....Power Outlets
 - 467-07.....Grounding and Bonding Equipment
 - 498-07.....Attachment Plugs and Receptacles
 - 943-11.....Ground-Fault Circuit-Interrupters
 - 1449-07.....Surge Protective Devices
 - 1472-96.....Solid State Dimming Controls

PART 2 - PRODUCTS

2.1 RECEPTACLES

- A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
 - 1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.

2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.
- B. Duplex Receptacles: Hospital-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation.
 1. Bodies shall be ivory in color.
 2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The lower receptacle shall be unswitched.
 3. Duplex Receptacles on Emergency Circuit:
 - a. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.
 4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring.
 - a. Ground fault interrupter shall be consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or - 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
 - b. Ground Fault Interrupter Duplex Receptacles (not hospital-grade) shall be the same as ground fault interrupter hospital-grade receptacles except for the hospital-grade listing.
 5. Safety Type Duplex Receptacles:
 - a. Bodies shall be gray in color.
 - 1) Shall permit current to flow only while a standard plug is in the proper position in the receptacle.
 - 2) Screws exposed while the wall plates are in place shall be the tamperproof type.
 6. Duplex Receptacles (not hospital grade): Shall be the same as hospital grade duplex receptacles except for the hospital grade listing and as follows.
 - a. Bodies shall be brown nylon.

- C. Receptacles; 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.
- D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

2.2 TOGGLE SWITCHES

- A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory in color unless otherwise specified or shown on the drawings.
 - 1. Switches installed in hazardous areas shall be explosion-proof type in accordance with the NEC and as shown on the drawings.
 - 2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
 - 3. Switches shall be rated 20 amperes at 120-277 Volts AC.

2.3 MANUAL DIMMING CONTROL

- A. Electronic full-wave manual slide dimmer with on/off switch and audible frequency and EMI/RFI suppression filters.
- B. Manual dimming controls shall be fully compatible with fluorescent electronic dimming ballasts and approved by the ballast manufacturer and LED dimming driver and be approved by the manufacturer, shall operate over full specified dimming range, and shall not degrade the performance or rated life of the electronic dimming ballast and lamp.
- C. Provide single-pole or three-way, as shown on the drawings.
- D. Manual dimming control and faceplates shall be ivory in color unless otherwise specified.

2.4 WALL PLATES

- A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.
- C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

- D. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.
- E. Duplex Receptacles on Emergency Circuit: Wall plates shall be red nylon with the word "EMERGENCY" engraved in 6 mm (1/4 inch) white letters. Wall plates shall be type 302 stainless steel, with the word "EMERGENCY" engraved in 6 mm (1/4 inch) red letters. Receptacles shall be red in color.

2.5 SURFACE MULTIPLE-OUTLET ASSEMBLIES

- A. Shall have the following features:
 - 1. Enclosures:
 - a. Thickness of steel shall be not less than 1 mm (0.040 inch) for base and cover. Nominal dimensions shall be 40 mm x 70 mm (1-1/2 inches by 2-3/4 inches) with inside cross sectional area not less than 2250 square mm (3-1/2 square inches). The enclosures shall be thoroughly cleaned, phosphatized, and painted at the factory with primer and the manufacturer's standard baked enamel finish.
 - 2. Receptacles shall be duplex, hospital grade. See paragraph 'RECEPTACLES' in this Section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.
 - 3. Unless otherwise shown on drawings, receptacle spacing shall be 600 mm (24 inches) on centers.
 - 4. Conductors shall be as specified in Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE.
 - 5. Installation fittings shall be the manufacturer's standard bends, offsets, device brackets, inside couplings, wire clips, elbows, and other components as required for a complete system.
 - 6. Bond the assemblies to the branch circuit conduit system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC and as shown as on the drawings.
- B. Install wiring devices after wall construction and painting is complete.

- C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.
- D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.
- E. Provide barriers in multigang outlet boxes to comply with the NEC.
- F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.
- G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.
- H. Install wall switches 1.2 M (48 inches) above floor, with the toggle OFF position down.
- I. Install wall dimmers 1.2 M (48 inches) above floor.
- J. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.
- K. Install vertically mounted receptacles with the ground pin up. Install horizontally mounted receptacles with the ground pin to the right.
- L. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.
- M. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Perform manufacturer's required field checks in accordance with the manufacturer's recommendations. In addition, include the following:
 - 1. Visual Inspection and Tests:
 - a. Inspect physical and electrical condition.
 - b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.
 - c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable

receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

d. Test GFCI receptacles.

2. Healthcare Occupancy Tests:

a. Test hospital grade receptacles for retention force per NFPA 99.

---END---

SECTION 26 43 13
SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of Type 2 Surge Protective Devices, as defined in NFPA 70, and indicated as transient voltage surge suppression or TVSS in this section.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- B. Section 26 23 00, LOW-VOLTAGE SWITCHGEAR: For factory-installed or external TVSS.
- C. Section 26 24 13, DISTRIBUTION SWITCHBOARDS: For factory-installed or external TVSS.
- D. Section 26 24 16, PANELBOARDS: For factory-installed or external TVSS.
- E. Section 26 26 00, POWER DISTRIBUTION UNITS FOR STATIC UNINTERRUPTIBLE POWER SYSTEMS: For factory-installed or external TVSS.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
 - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - b. Include electrical ratings and device nameplate data.
 2. Manuals:
 - a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
 3. Certifications: Two weeks prior to final inspection, submit the following.

- a. Certification by the manufacturer that the TVSS conforms to the requirements of the drawings and specifications.
- b. Certification by the Contractor that the TVSS has been properly installed.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplement and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Institute of Engineering and Electronic Engineers (IEEE):
 - IEEE C62.41.2-02.....Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
 - IEEE C62.45-03.....Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
- C. National Fire Protection Association (NFPA):
 - 70-11.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
 - UL 1283-05.....Electromagnetic Interference Filters
 - UL 1449-06.....Surge Protective Devices

PART 2 - PRODUCTS

2.1 SWITCHGEAR/SWITCHBOARD TVSS

- A. General Requirements:
 - 1. Comply with IEEE and UL.
 - 2. Modular design with field-replaceable modules, or non-modular design.
 - 3. Fuses, rated at 200 kA interrupting capacity.
 - 4. Bolted compression lugs for internal wiring.
 - 5. Integral disconnect switch.
 - 6. Redundant suppression circuits.
 - 7. LED indicator lights for power and protection status.
 - 8. Audible alarm, with silencing switch, to indicate when protection has failed.
 - 9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.

10. Four-digit transient-event counter.

B. Surge Current per Phase: Minimum 240kA per phase.

2.2 PANELBOARD TVSS

A. General Requirements:

1. Comply with UL 1449 and IEEE C62.41.2.
2. Modular design with field-replaceable modules, or non-modular design.
3. Fuses, rated at 200 kA interrupting capacity.
4. Bolted compression lugs for internal wiring.
5. Integral disconnect switch.
6. Redundant suppression circuits.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
10. Four-digit transient-event counter.

B. Surge Current per Phase: Minimum 120kA per phase.

2.3 ENCLOSURES

A. Enclosures: NEMA 1 or 3r if outside.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Factory-installed TVSS: Switchgear, switchboard, or panelboard manufacturer shall install TVSS at the factory.
- B. Field-installed TVSS: Contractor shall install TVSS with conductors or buses between TVSS and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
 1. Provide a circuit breaker as a dedicated disconnecting means for TVSS as shown on drawings.
- C. Do not perform insulation resistance tests on switchgear, switchboards, panelboards, or feeders with the TVSS connected. Disconnect TVSS before conducting insulation resistance tests, and reconnect TVSS immediately after insulation resistance tests are complete.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests:

- a. Compare equipment nameplate data with specifications and approved shop drawings.
- b. Inspect physical, electrical, and mechanical condition.
- c. Verify that disconnecting means and feeder size and maximum length to TVSS corresponds to approved shop drawings.
- d. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.
- e. Vacuum-clean enclosure interior. Clean enclosure exterior.
- f. Verify the correct operation of all sensing devices, alarms, and indicating devices.

3.3 FOLLOW-UP VERIFICATION

A. After completion of acceptance checks and tests, the Contractor shall show by demonstration in service that TVSS are in good operating condition and properly performing the intended function.

3.4 INSTRUCTION

A. Provide the services of a factory-trained technician for one 2-hour training period for instructing personnel in the maintenance and operation of the TVSS, on the date requested by the Resident Engineer.

---END---

**SECTION 26 51 00
INTERIOR LIGHTING**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies the furnishing, installation, and connection of the interior lighting systems. The terms "lighting fixture," "fixture," and "luminaire" are used interchangeably.

1.2 RELATED WORK

- A. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT: Disposal of lamps.
- B. Section 02 41 00, DEMOLITION: Removal and disposal of lamps and ballasts.
- C. Section 10 25 13, PATIENT BED SERVICE WALLS: Power and controls for wall-mounted fluorescent bedlight fixtures.
- D. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- E. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- G. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:

- a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
- b. Material and construction details include information on housing and optics system.
- c. Physical dimensions and description.
- d. Wiring schematic and connection diagram.
- e. Installation details.
- f. Energy efficiency data.

- g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
 - h. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours), and color temperature (degrees Kelvin).
 - i. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts, and total harmonic distortion (THD).
 - j. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.
2. Manuals:
- a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
- a. Certification by the Contractor that the interior lighting systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
 - C78.1-91.....Fluorescent Lamps - Rapid-Start Types -
Dimensional and Electrical Characteristics
 - C78.376-01.....Chromaticity of Fluorescent Lamps
- C. American Society for Testing and Materials (ASTM):
 - C635-07.....Manufacture, Performance, and Testing of Metal
Suspension Systems for Acoustical Tile and Lay-
in Panel Ceilings
- D. Environmental Protection Agency (EPA):
 - 40 CFR 261.....Identification and Listing of Hazardous Waste
- E. Federal Communications Commission (FCC):

- CFR Title 47, Part 15...Radio Frequency Devices
- CFR Title 47, Part 18...Industrial, Scientific, and Medical Equipment
- F. Illuminating Engineering Society (IES):
- LM-79-08.....Electrical and Photometric Measurements of
Solid-State Lighting Products
- LM-80-08.....Measuring Lumen Maintenance of LED Light
Sources
- LM-82-12.....Characterization of LED Light Engines and LED
Lamps for Electrical and Photometric Properties
as a Function of Temperature
- G. Institute of Electrical and Electronic Engineers (IEEE):
- C62.41-91.....Surge Voltages in Low Voltage AC Power Circuits
- H. International Code Council (ICC):
- IBC-12.....International Building Code
- I. National Fire Protection Association (NFPA):
- 70-11.....National Electrical Code (NEC)
- 101-12.....Life Safety Code
- J. National Electrical Manufacturer's Association (NEMA):
- C82.1-04.....Lamp Ballasts - Line Frequency Fluorescent Lamp
Ballasts
- C82.2-02.....Method of Measurement of Fluorescent Lamp
Ballasts
- C82.4-02.....Lamp Ballasts - Ballasts for High-Intensity
Discharge and Low-Pressure Sodium (LPS) Lamps
(Multiple-Supply Type)
- C82.11-11.....Lamp Ballasts - High Frequency Fluorescent Lamp
Ballasts
- LL-9-09.....Dimming of T8 Fluorescent Lighting Systems
- SSL-1-10.....Electronic Drivers for LED Devices, Arrays, or
Systems
- K. Underwriters Laboratories, Inc. (UL):
- 496-08.....Lampholders
- 542-0599.....Fluorescent Lamp Starters
- 844-12.....Luminaires for Use in Hazardous (Classified)
Locations
- 924-12.....Emergency Lighting and Power Equipment
- 935-01.....Fluorescent-Lamp Ballasts
- 1029-94.....High-Intensity-Discharge Lamp Ballasts

1029A-06.....	Ignitors and Related Auxiliaries for HID Lamp Ballasts
1598-08.....	Luminaires
1574-04.....	Track Lighting Systems
2108-04.....	Low-Voltage Lighting Systems
8750-09.....	Light Emitting Diode (LED) Light Sources for Use in Lighting Products

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

- A. Shall be in accordance with NFPA, UL, as shown on drawings, and as specified.
- B. Sheet Metal:
 - 1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
 - 2. Wireways and fittings shall be free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.
 - 3. When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.
 - 4. Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.
- C. Ballasts and lamps shall be serviceable while the fixture is in its normally installed position. Ballasts shall not be mounted to removable reflectors or wireway covers unless so specified.
- D. Lamp Sockets:
 - 1. Fluorescent: Single slot entry type, requiring a one-quarter turn of the lamp after insertion. Lampholder contacts shall be the biting edge type.
 - 2. Compact Fluorescent: 4-pin.
 - 3. High Intensity Discharge (HID): Porcelain.
- E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.
- F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

G. Metal Finishes:

1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
3. Exterior finishes shall be as shown on the drawings.

H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

I. Light Transmitting Components for Fluorescent Fixtures:

1. Shall be 100 percent virgin acrylic.
2. Flat lens panels shall have not less than 3 mm (1/8 inch) of average thickness.
3. Unless otherwise specified, lenses, reflectors, diffusers, and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction without distortion or cracking.

J. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Division areas as defined in NFPA 70.

K. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballast integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures.

2.2 BALLASTS

- A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V), electronic, instant-start, programmed-start, rapid-start type, designed for type and quantity of lamps indicated. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated. Ballasts shall include the following features:
1. Lamp end-of-life detection and shutdown circuit (T5 lamps only).
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.

4. Total Harmonic Distortion (THD): 10 percent or less.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. Ballast Factor: 0.87 or higher unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. EMR/RFI Interference: Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 11. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
 12. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.
 13. Dimming ballasts shall be as per above, except dimmable from 100% to 2% of rated lamp lumens. Dimming ballasts shall be fully compatible with the dimming controls.
- B. Low-Frequency Linear T8 Fluorescent Lamp Ballasts (allowed for Critical Care Units): Multi-voltage (120 - 277V), hybrid electronic-electromagnetic rapid-start type, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output. Ballasts shall include the following features:
1. Automatic lamp starting after lamp replacement.
 2. Sound Rating: Class A.
 3. Total Harmonic Distortion (THD): 20 percent or less.
 4. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 5. Operating Frequency: 60 Hz.

6. Lamp Current Crest Factor: 1.7 or less.
 7. Ballast Factor: 0.85 or higher unless otherwise indicated.
 8. Power Factor: 0.90 or higher.
 9. Interference: Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 10. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
 11. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.
- C. Compact Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V), electronic programmed rapid-start type, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated. Ballasts shall include the following features:
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion (THD): 10 percent or less.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. Ballast Factor: 0.95 or higher unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

11. Dimming ballasts shall be as per above, except dimmable from 100% to 2% of rated lamp lumens. Dimming ballasts shall be fully compatible with the dimming controls.
- D. Ballasts for HID fixtures: Multi-tap voltage (120 - 480V) electromagnetic ballast for high intensity discharge lamps. Include the following features unless otherwise indicated:
 1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 3. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

2.3 FLUORESCENT EMERGENCY BALLAST

- A. Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture housing and compatible with ballast.
 1. Emergency Connection: Operate two fluorescent lamp(s) continuously at an output of 1400 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 5. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.4 EMERGENCY LIGHTING UNIT

- A. Complete, self-contained unit with batteries, battery charger, one or more local or remote lamp heads with lamps, under-voltage relay, and test switch.
 - 1. Enclosure: Shall be cast aluminum. Enclosure shall be suitable for the environmental conditions in which installed.
 - 2. Lamp Heads: Horizontally and vertically adjustable, mounted on the face of the unit, except where otherwise indicated.
 - 3. Lamps: Shall be sealed-beam MR-16 halogen, rated not less than 12 watts at the specified DC voltage.
 - 4. Battery: Shall be maintenance-free nickel-cadmium. Minimum normal life shall be minimum of 10 years.
 - 5. Battery Charger: Dry-type full-wave rectifier with charging rates to maintain the battery in fully-charged condition during normal operation, and to automatically recharge the battery within 12 hours following a 1-1/2 hour continuous discharge.
 - 6. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.5 LAMPS

- A. Linear and U-shaped T5 and T8 Fluorescent Lamps:
 - 1. Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature between 3500° and 4100°K, a Color Rendering Index (CRI) equal or greater than 80, average rated life equal to or greater than 24,000 hours when used with an instant start ballast and 30,000 hours when used with a programmed or rapid start ballast (based on 3 hour starts), and be suitable for use with dimming ballasts, unless otherwise indicated.
 - a. Over the beds in Intensive Care, Coronary Care, Recovery, Life Support, and Observation and Treatment areas; Electromyographic, Autopsy (Necropsy), Surgery, and certain dental rooms (Examination, Oral Hygiene, Oral Surgery, Recovery, Labs, Treatment, and X-Ray) use color corrected lamps having a CRI of 85 or above and a correlated color temperature between 5000 and 6000°K, as shown on the drawings.
 - b. Other areas as shown on the drawings.
 - 2. Lamps shall comply with EPA Toxicity Characteristic Leachate Procedure (TCLP) requirements.

B. Compact Fluorescent Lamps:

1. T4, CRI 80 (minimum), color temperature 3500°K, average rated life equal to or greater than 12,000 hours (based on 3 hour starts), and suitable for use with dimming ballasts, unless otherwise indicated.
2. Lamps shall comply with EPA Toxicity Characteristic Leachate Procedure (TCLP) requirements.

2.6 WALL MOUNTED FLUORESCENT BEDLIGHT FIXTURES

- A. Fixtures shall be lensed.
- B. Fixtures shall be rated for 120 Volt operation, and be powered through the patient wall unit per Section 10 25 13, PATIENT BED SERVICE WALLS.
- C. Provide 4-position, pull cord switch to control the upward and downward portion of the light separately and simultaneously. Include an off position, except in single bed rooms where the switch shall energize and de-energize the downward light only. In the single bed rooms, provide a 2-position pull cord switch for "on-off" control of the downward lamps.
- D. Provide low-voltage relays and switching integration with patient bed controls.

2.7 LED EXIT LIGHT FIXTURES

- A. Exit light fixtures shall meet applicable requirements of NFPA and UL.
- B. Housing and door shall be die-cast aluminum.
- C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.
- D. Finish shall be satin or fine-grain brushed aluminum.
- E. There shall be no radioactive material used in the fixtures.
- F. Fixtures:
 1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
 2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
 3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltage: Multi-voltage (120 - 277V).

2.8 LED LIGHT FIXTURES

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
3. LED drivers shall include the following features unless otherwise indicated:
 - a. Minimum efficiency: 85% at full load.
 - b. Minimum Operating Ambient Temperature: -20° C. (-4° F.)
 - c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
 - d. Integral short circuit, open circuit, and overload protection.
 - e. Power Factor: ≥ 0.95 .
 - f. Total Harmonic Distortion: $\leq 20\%$.
 - g. Comply with FCC 47 CFR Part 15.
4. LED modules shall include the following features unless otherwise indicated:
 - a. Comply with IES LM-79 and LM-80 requirements.
 - b. Minimum CRI 80 and color temperature 3000° K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
 - c. Minimum Rated Life: 50,000 hours per IES L70.
 - d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. LED Downlights:

1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers:

1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
2. Housing, LED driver, and LED module shall be products of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.
- B. Align, mount, and level the lighting fixtures uniformly.

C. Wall-mounted fixtures shall be attached to the studs in the walls, or to a 20 gauge metal backing plate that is attached to the studs in the walls. Lighting fixtures shall not be attached directly to gypsum board.

D. Lighting Fixture Supports:

1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
4. Hardware for recessed lighting fixtures:
 - a. All fixture mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of 400 percent of the fixture weight.
 - b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass through the ceiling member (T-bar, channel or spline), or it may extend over the inside of the flange of the channel (or spline) that faces away from the fixture, in a manner that prevents any fixture movement.
 - c. In addition to the above, the following is required for fixtures exceeding 9 kg (20 pounds) in weight.
 - 1) Where fixtures mounted in ASTM Standard C635 "Intermediate Duty" and "Heavy Duty" ceilings and weigh between 9 kg and 25 kg (20 pounds and 56 pounds), provide two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
 - 2) Where fixtures weigh over 25 kg (56 pounds), they shall be independently supported from the building structure by

approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.

- d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
7. Surface mounted lighting fixtures:
- a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4 inch) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.
 - b. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
 - c. Fixtures less than 6.8 kg (15 pounds) in weight and occupying less than 3715 sq cm (two square feet) of ceiling area may, when designed for the purpose, be supported directly from the outlet box when all the following conditions are met.
 - 1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
 - 2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
 - 3) The outlet box is supported vertically from the building structure.
 - d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
8. Single or double pendant-mounted lighting fixtures:
- a. Each stem shall be supported by an approved outlet box mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.

9. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- E. Furnish and install the new lamps as specified for all lighting fixtures installed under this project, and for all existing lighting fixtures reused under this project.
- F. The electrical and ceiling trades shall coordinate to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges, etc.), to match the ceiling system being installed.
- G. Bond lighting fixtures to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- H. At completion of project, replace all defective components of the lighting fixtures at no cost to the Government.
- I. Dispose of lamps per requirements of Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT, and Section 02 41 00, DEMOLITION.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Perform the following:
 1. Visual Inspection:
 - a. Verify proper operation by operating the lighting controls.
 - b. Visually inspect for damage to fixtures, lenses, reflectors, diffusers, and louvers. Clean fixtures, lenses, reflectors, diffusers, and louvers that have accumulated dust, dirt, or fingerprints during construction.
 2. Electrical tests:
 - a. Exercise dimming components of the lighting fixtures over full range of dimming capability by operating the control devices(s) in the presence of the Resident Engineer. Observe for visually detectable flicker over full dimming range, and replace defective components at no cost to the Government.
 - b. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless specifically recommended otherwise by the lamp manufacturer. Burn-in dimmed fluorescent and compact fluorescent lamps for at least 100 hours at full voltage, unless

specifically recommended otherwise by the lamp manufacturer.

Replace any lamps and ballasts which fail during burn-in.

3.3 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting systems are in good operating condition and properly performing the intended function.

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