

**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 the VA Palo Alto Dialysis Suite Renovation project as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Contracting Officer Technical Representative (COTR).
- C. N/A
- D. 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.
- E. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2) will maintain a presence at the work site whenever the general or subcontractors are present.
- F. Training:
  - 1. All employees of general contractor or subcontractors shall have the 30-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team.
  - 2. Submit training records of all such employees for approval before the start of work.

**1.2 STATEMENT OF BID ITEM(S)**

- A. GENERAL CONSTRUCTION: Work includes general construction, demolition, alterations, plumbing, mechanical and electrical work, utility systems, finishes, flooring, window coverings and necessary removal of existing structures and construction and certain other items.
- B. OVERVIEW:

1. The existing Dialysis Suite Finishes Upgrades at VA Palo Alto Health Care System is being remodeled to accommodate additional patient dialysis stations and other upgrades. Project includes renovations of, offices and staff work areas. Work will include new finishes (flooring, wall finishes and ceilings), casework, door replacement, minor electrical work, sink installations, and remediation work. Project includes modifications to the existing Dialysis treatment system.
2. A key component of the project will be that only half of the facility may be renovated at a time, with the other half in use by patients and staff during that first phase. Modifications to the existing dialysis delivery and other MEP systems will be required to accommodate this required phasing.
3. Intent is that the project will provide a complete and functional Dialysis Suite with additional patient treatment stations as indicated.
4. This scope of work should be used as a general guide to the work incorporated into the Contract Documents (Drawings and Specifications) but where there are discrepancies, the Contract Documents (Drawings and Specifications) shall govern over this SCOPE OF WORK, unless the scope is increased by this section in which case the greater scope description shall govern.

C. SCOPE OF WORK:

1. Demolition and Re-Construction of existing Dialysis Suite at VA Palo Alto at the 2<sup>nd</sup> Floor of Building 100, as indicated in the below tasks room by room and areas
2. Work will be inside a functioning hospital and Bidding Contractors may not interrupt hospital functions at any time without appropriate approvals by the VA.
3. Noisy work by the Contractor may be asked to be terminated at any time by the VA, with not change to the contract sum or duration. Off-hour weekend and night work is required for any noise as well as core drilling or shutdowns. Contractor shall schedule work as required to accommodate all hospital functions/operations.

4. Appropriate infection control and interim life safety measures shall be implemented by the Contractor.

### **1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR**

- A. AFTER AWARD OF CONTRACT, ONE set of printed specifications and attachments and ONE CD with specifications and attachments in PDF format will be furnished to the contractor.
- C. The contractor shall maintain on site ONE printed set of specifications, ONE printed set of attachments, ONE printed set of all RFI's, RFP's and other documents that modify the original specifications and attachments.

### **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 sub-contractors working on the project and their employees also comply with these regulations.
3. The contractor shall submit their SECURITY PLAN. The SECURITY PLAN shall be submitted within 10 day of the contract award. The Notice To Proceed (NTP) will not be issued until the SECURITY PLAN is approved.

#### **B. Security Procedures:**

1. Worksites locate within occupied buildings will be locked at all times. Install a passage way lockset that will receive a "Best" lock core. The lock core will installed by the VAPA. The VAPA will provide as many keys as requested by the contractor. As an alternate the contractor may install a cipher lock, this lock must be capable of being opened with a "Best" lock key. The lock core will be installed by the VAPA.
2. 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.

Daily contractor identification badges are issued by the VAPA Police department.

3. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 7 work day's notice to the Construction Project Manager so that security, escort, arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
4. No photography of VA premises is allowed without written permission of the Contracting Officer.
5. 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 Contracting Officer.

C. Guards:

1. Not Used.

D. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the Construction Project Manager 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.

E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors 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.

4. 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 Contracting Officer upon request.
5. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
6. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
7. Notify Contracting Officer and VAPA Police immediately when there is a loss or compromise of "sensitive information".
8. 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.

F. 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.
3. Parking is VERY limited at the site the Contractor shall arrange to use VAPA off-site parking for contractor and subcontractor employees or otherwise coordinate parking with the Construction project Manager.

## 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

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

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 the Construction Project Manager who will have the plan reviewed by the VAPA Safety Department for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. The Notice To Proceed (NTP) will not be issued until the FIRE SAFETY PLAN is approved.

C. Prior to any worker for the contractor or subcontractors beginning work, they 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, VAPA safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAPA equipment, etc. Documentation shall be provided to the Resident Engineer that individuals 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 6 m (20 feet) exposing overall length, separate by 3m (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. See 1.4 Construction Security Requirements, B. Security Procedures for lock requirements.
  - 2. Install one-hour temporary construction partitions as shown on drawings or as required to separate the work site from the occupied portion of the building 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 Resident Engineer.

- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Resident Engineer.
- I. Fire Extinguishers: Provide, maintain and show proof of extinguisher maintenance at least one fire extinguisher per room 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 if required.
- 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 Resident Engineer. 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 Resident Engineer.
- M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Resident Engineer.
- N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. VAPA Memorandum No. SAFE-09-6 Dated October 13, 2009 contains all Hot Work Permit requirements this is located in RULES OF THE STATION. Obtain a Hot Work Permit from the SAFE Service. Coordinate with the Construction Project manager.
- O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Construction Project Manager.
- 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 at the end of each work shift.
- R. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

#### **1.5.1 CONSTRUCTION SAFETY REQUIREMENTS**

##### **A. Safety Plan:**

1. The safety plan defines both physical and administrative safety procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all contractor and sub-contractors working on the project and their employees also comply with these regulations.
3. The contractor shall submit a SAFETY PLAN that written specifically for this contract. The SAFETY PLAN shall be submitted within 10 day of the contract award. The Notice To Proceed (NTP) will not be issued until the SAFETY PLAN is approved.
4. The SAFETY PLAN shall serve as reference document that any contractor or sub contractor employee can use to find the correct course of action in an emergency.

#### **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 Contracting Officer. 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 Contracting Officer 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 Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. 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. **(FAR 52.236-10)**
- D. Working space and space available for storing materials shall be as determined by the Construction Project Manager.
- E. Workmen are subject to rules of VAPA applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of VAPA 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, except for when authorized by the Construction Project Manager.
1. Do not store materials and equipment in other than assigned areas.
  2. Provide unobstructed access to the VAPA areas required to remain in operation.
  3. Where access by VAPA 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.
- G. Phasing:
1. Contractor shall schedule work to room by room and approved schedule with COR. Contractor must gain concurrence from COR for doing multiple rooms at once.
- I. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps

and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by Construction Project Manager.

- J. When a building, or part of a building, is turned over to Contractor, Contractor shall accept entire responsibility therefore.

#### **1.7 ALTERATIONS**

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the Construction Project Manager and a representative of VA Facilities, of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. 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 Resident Engineer.
- 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 Construction Project Manager, to be in such condition that their use is impossible or impractical, shall be furnished and/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 clause 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 Construction Project Manager 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 VAPA'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 and indicated on the drawings. Prior to start of work, prepare a INFECTIOUS PREVENTION PLAN detailing project-specific dust protection measures, including periodic status reports, and submit to the Construction Project Manager and Facility ICRA team for review for compliance with

contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. The Notice To Proceed (NTP) will not be issued until the INFECTIOUS PREVENTION PLAN is approved.

1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the VAPA. All personnel working on the project are required to watch the video "Infection Control During Construction".

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 Construction Project Manager 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. The contractor shall install negative air machines as directed by the Construction Project Manager and shall be required to add machines as directed.
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 Resident Engineer. **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 Construction Project Manager. 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 temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Construct the dust proof barrier with a one hour fire rating. 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 in certain circumstances where hard walls cannot be constructed and an agreement is reached with the Construction Project Manager and VAPA Fire Protection Specialist.
- b. HEPA filtration is required. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% 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. The contractor shall install a state of the art air pressure differential monitor. The monitor shall be placed at such a location that anyone entering or leaving the work site shall be able to determine if negative air pressure is being maintained.
- d. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied medical center area. A Shop Vac with HEPA filtration shall be places at any exit from the work site. These Shop Vac's shall be used to remove dust that has accumulated on workers clothing while working whenever they leave the work site. These mats shall be changed as often by the as directed Construction Project Manager to maintain clean work areas directly outside construction area at all times.

- e. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Shop Vacs and Vacuum cleaners 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.
- f. The contractor shall not haul debris through patient-care areas without prior approval of the Construction Project Manager and the VAPA. 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 wheel treads and 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. Wheels and tires shall not track debris on floors outside the work zone.
- g. 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.
- h. 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 4 hours. Remove and dispose of porous materials that remain damp for more than 24 hours.
- i. 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 including above ceiling spaces. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.

3. All new air ducts and air ducts subject to dust from the construction activity 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 or noted on drawings or in specifications 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 re installation and reuse. Store such items were directed by Construction Project Manager.
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.
4. PCB Transformers and Capacitors: The Contractor shall be responsible for disposal of the Polychlorinated Biphenyl (PCB) transformers and capacitors. The transformers and capacitors shall be taken out of service and handled in accordance with the procedures of the Environmental Protection Agency (EPA) and the Department of Transportation (DOT) as outlined in Code of Federal Regulation (CFR), Titled 40 and 49 respectively. The EPA's Toxic Substance Control Act (TSCA) Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7 also apply. Upon removal of PCB transformers and capacitors for disposal, the "originator" copy of the Uniform Hazardous Waste Manifest (EPA Form 8700-22), along with the Uniform Hazardous Waste Manifest Continuation Sheet (EPA Form 8700-22A) shall be returned to the Contracting Officer who will annotate the contract file and transmit the Manifest to the Medical Center's Chief.



- a. Copies of the following listed CFR titles may be obtained from the Government Printing Office:

40 CFR 261.....Identification and Listing of Hazardous Waste

40 CFR 262.....Standards Applicable to Generators of Hazardous Waste

40 CFR 263.....Standards Applicable to Transporters of Hazardous Waste

40 CFR 761.....PCB Manufacturing, Processing, Distribution in Commerce, and use Prohibitions

49 CFR 172.....Hazardous Material tables and Hazardous Material Communications Regulations

49 CFR 173.....Shippers - General Requirements for Shipments and Packaging

49 CFR 173.....Subpart A General

49 CFR 173.....Subpart B Preparation of Hazardous Material for Transportation

49 CFR 173.....Subpart J Other Regulated Material; Definitions and Preparation

TSCA.....Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7

5. Lead based paint found but not identified by the government shall not be disturbed. Notify the Construction Project Manager immediately and await further instructions.
6. Asbestos or asbestos containing material found but not identified by the government shall not be disturbed. Notify the Construction Project Manager immediately and await further instructions.
7. Other hazardous material if found but not identified by the government shall not be disturbed. Notify the Construction Project Manager immediately and await further instructions.

**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 Contracting Officer.
- 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 Contracting Officer may have the necessary work performed and charge the cost to the Contractor. **(FAR 52.236-9)**
- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.
- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. If a National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and

operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:

- Designating areas for equipment maintenance and repair;
- Providing waste receptacles at convenient locations and provide regular collection of wastes;
- Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
- Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
- Providing adequately maintained sanitary facilities.

#### **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 Construction Project Manager. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the Resident Engineer 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 clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

#### **1.12 WORK HOURS**

- A. All work is to be performed between the hours of **7:00AM** and **4:30PM**. The contractor has the option of working 8:30PM Sunday to 5AM Friday.
- B. All work shall be performed in five 8 hour work days. Modified work weeks of four 10 hour work days is not permitted.
- C. Any work outside of these hours shall be requested in writing to the Construction Project Manager. Work outside of these hours is governed by utility shut down requirements or other applicable VAPA rules. If no other requirements are applicable then 5 working days notice is required.

#### **1.13 PIPE FREEZING IN LEW OF UTILITY SHUT DOWN**

- A. The contractor shall whenever possible isolate water services via the commercial process known as pipe freezing. This shall not require the attendance of VAPA shop personnel.
- B. Isolation valves shall be installed whenever the freezing process is used.
- C. All personnel involved in the pipe freezing process shall have proof of training in this method.

#### **1.14 LAYOUT OF WORK**

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. This applies to new construction and change of use of existing buildings. 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 Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them.

If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor. (**FAR 52.236-17**)

- B. Establish and plainly mark center lines for each building and/or addition to each existing building and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure and/or addition, roads, parking lots are in accordance with lines and elevations shown on contract drawings.
- C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs:
  - 1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the Resident Engineer before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.
- D. During progress of work, and particularly as work progresses from floor to floor, Contractor shall have line grades and plumbness of all major form work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the Resident Engineer before any major items of concrete work are placed. In addition, Contractor shall also furnish to the Resident Engineer certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.
  - 1. Lines of each building and/or addition.
  - 2. Elevations of bottoms of footings and tops of floors of each building and/or addition.

3. Lines and elevations of sewers and of all outside distribution systems.
4. Lines and elevations of roads, streets and parking lots.
- E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to Construction Project Manager.
- F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

#### **1.15 AS-BUILT DRAWINGS**

- A. The contractor shall maintain two full size sets of as-built drawings on the job site 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 Construction Project Manager's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the Construction Project Manager within 15 calendar days after each completed phase (if the project is phased) and after the acceptance of the project by the Construction Project Manager.
- D. Paragraphs A, B, & C shall also apply to all shop drawings, manuals and other contract required documents.
- E. Final payment shall not be made before receipt of all as built drawings, manuals and other contract documentation by the Construction Project Manager.

#### **1.16 USE OF ROADWAYS**

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the Construction Project Manager, 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.

- B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.
- C. When certain buildings (or parts of certain buildings) are required to be completed in advance of general date of completion, all roads leading thereto must be completed and available for use at time set for completion of such buildings or parts thereof.

#### **1.17 RESIDENT ENGINEERS FIELD OFFICE**

- A. NOT USED.

#### **1.18 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 Construction Project Manager. If the equipment is not installed and maintained in accordance with the following provisions, the Construction Project Manager will withdraw permission for use of the equipment.
  - 2. 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.
  - 3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.

4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
  5. 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.
  6. 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. Boilers, pumps, feed water heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel. Boiler water must be given complete and continuous chemical treatment.
- B. Prior to final inspection, all equipment used by the contractor shall be inspected by the Resident Engineer, equipment or parts used which show wear and tear beyond normal, as determined by the Construction Project Manager, 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.

#### **1.19 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 Construction Project Manager for use of elevators. The Construction Project manager will ascertain that elevators are in proper condition. Contractor shall use elevator Nos. 6 in Building 100 for moving all debris, materials, tools and equipment. All other elevators may be used for the transportation of personnel only. 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.
3. Government will accept hoisting ropes of elevator and rope of each speed governor if they are worn under normal operation. However, if these ropes are damaged by action of foreign matter such as sand, lime, grit, stones, etc., during temporary use, they shall be removed and replaced by new hoisting ropes.
4. If brake lining of elevators are excessively worn or damaged during temporary use, they shall be removed and replaced by new brake lining.
5. All parts of main controller, starter, relay panel, selector, etc., worn or damaged during temporary use shall be removed and replaced with new parts, if recommended by elevator inspector after elevator is released by Contractor.
6. Place elevator in condition equal, less normal wear, to that existing at time it was placed in service of Contractor as approved by Contracting Officer.

**1.20 NOT USED**

- A. NOT USED.

**1.21 TEMPORARY TOILETS**

- A. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by the 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.
- B. When toilet accommodations are not available the contractor shall provide portable toilets.

**1.22 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. Heat: If needed 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.
- C. Electricity (for Construction and Testing): If needed 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.
- D. Water (for Construction and Testing): If needed 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 Construction Project Manager's discretion) of use of water from Medical Center's system. Any damage due to water leaks shall be repaired at the contractors expense.

E. Steam: If needed furnish steam system for testing required in various sections of specifications.

1. Obtain steam for testing by connecting to the Medical Center steam distribution system. Steam is available at no cost to the Contractor.
2. Maintain connections, pipe, fittings and fixtures and conserve steam use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at Construction Project Manager's discretion), of use of steam from the Medical Center's system.

F. Fuel: Natural and LP gas and burner fuel oil required for boiler cleaning, normal initial boiler-burner setup and adjusting, and for performing the specified boiler tests will be furnished by the Government. Fuel required for prolonged boiler-burner setup, adjustments, or modifications due to improper design or operation of boiler, burner, or control devices shall be furnished by the Contractor at Contractor's expense. The use of these products is restricted to the boiler building only.

#### **1.23 NEW TELEPHONE AND DATA EQUIPMENT**

If the contract does not require the contractor to install telephone and data equipment the contractor shall coordinate with the work of installation of telephone and data equipment by others. This work shall be completed before the building is turned over to VA.

#### **1.24 TESTS**

- A. Pre test mechanical and electrical equipment and systems or other system installed as a result of this contract 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 Contracting Officer. 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, feed water, 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.
- F. A report of each test performed containing at a minimum all testing results, readings taken and any recommendations by the testers shall be submitted to the Construction Project Manager within 10 days of the completion of any test performed.

#### **1.25 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (two printed copies each and two on CD) for each separate piece of equipment shall be delivered to the Construction Project manager coincidental with the delivery of the equipment to the job site. 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. The final payment will not be processed until all manuals are delivered to the Construction Project Manager.
- D. 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 job site. 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 Resident Engineer and shall be considered concluded only when the Resident Engineer 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 Construction Project Manager, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

#### **1.26 GOVERNMENT-FURNISHED PROPERTY**

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on schedule's and/or drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.
- C. Notify Contracting Officer 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 Construction Project Manager 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.
- D. Equipment furnished by the Government may or may not 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.
- E. Completely assembly if required and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- F. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer or authorized distributor.

#### **1.27 RELOCATED EQUIPMENT AND/OR ITEMS**

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and/or 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 Construction Project Manager.
- 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.

#### **1.28 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT**

- A. Not Used.

#### **1.29 CONSTRUCTION SIGN**

- A. Not Used.

#### **1.30 SAFETY SIGN**

- A. Provide a Safety Sign where directed by the VA Construction Project Manager. Commercially made signs are acceptable.
- B. Maintain sign and remove it when directed by the VA Construction Project Manager.
- C. Post the number of accident free days on a daily basis.

#### **1.31 PHOTOGRAPHIC DOCUMENTATION**

- A. The contractor may find the need to photographically document existing conditions prior to working on some portion of the project or after the completion of a portion of the project. In addition the Construction Project Manager may require the need to photographically document existing conditions prior to working on some portion of the project or after the completion of a portion of the project.
- B. The contractor shall use a digital camera or cell phone to take the required photograph(s).
- C. The contractor shall provide copies of documentation photographs taken when requested by the Construction Project Manager. At the completion of the project the contractor shall provide copies of all documentation photographs taken of the project to the Construction Project manager.
- D. All photograph(s) shall be provided on CD's. In the interest of expediency, the contractor may on occasion need to provide advance copies of the photograph's via e-mail to the Construction Project Manager

**1.32 FINAL PHOTOGRAPHS**

A. Not Used.

**1.33 HISTORICAL**

A. Not Used.

**1.34 SUBMITTAL LIST**

A. Not Used.

**1.35 CODES**

A. CONSTRUCTION CODES: The following codes are used for this contract:

Building Code	IBC - International Building Code 2009
Structural Code	IBC - International Building Code 2009
Plumbing Code	IPC - International Plumbing Code 2009
Mechanical Code	IMC - International Mechanical code 2009
Electrical Code	NEC - National Electric Code 2008, NFPA 70
Hospital	Health Care Facilities Code, NFPA 99 2012
Fire/Life Safety Code	NFPA 2004/2005 Ed.
Accessibility Code	2003 ICC/ANSI A117.1
Energy Code	IECC - International Energy Conservation Code 2003
Elevator Code	ASME A17.1-3, ASME A18.1
Gas Code	IFGC - International Fuel Gas Code 2009

**1.36 PALO ALTO DIVISION SPECIAL REQUIREMENTS: (ATTACHMENTS)**

- A. Construction "Rules of the Station" for VAPAHCS
- B. Utility Shutdown Procedures - VAPAHCS Memo 138-08-14
- C. Sign-in/Acknowledgement Sheet for Utility Shut-Downs.
- D. Acceptable Construction Fencing Types.
- E. Site Safety Review Checklist
- F. ILSM (Interim Life Safety Measures) Matrix & Sample Matrix
- G. VAPAHCS Codes of Practice for Tel/Data Cabling Installations
- H. VAPAHCS Tel/Data Jack Conventions
- I. Project Construction Wall Flyer Notice - Sample



J. Hot Work Program Requirements - VAPAHCS Memo SAFE-09-06

**Attachment A:**

**Construction "Rules of the Station" for VAPAHCS**



# RULES OF THE STATION

## **RULES OF THE STATION**

### **VETERANS AFFAIRS PALO ALTO HEALTH CARE SYSTEM**

The guidelines published in this issue are for the use and convenience of construction and maintenance contractors, vendors and others performing contract work at all Divisions of the VA Palo Alto Health Care System.

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- Q. Removal of Government Property
- R. Sexual Harassment
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- T. Firearms and Explosive Devices
- U. Smoking
- V. Lost and Found
- W. Smoke Barrier Partitions
- X. Welding/Burning
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- Z. Occupational Health and Safety
- AA. Injury Accidents
- BB. Damage to Government Property
- CC. Dust and Fume Control
- DD. Noise
- EE. Roads and Walks
- FF. Fire Safety Precautions

- A. **CONTRACT WORK HOURS.** All work on the contract shall be performed between 8:00 am and 4:30pm Monday through Friday, excluding National Holidays, unless approved in writing by the Contracting Officer. Contractors may request, in writing, approval to work other hours or weekends. Except for emergencies, the contract person should receive such requests two weeks before the scheduled work. When possible, Contractors will submit emergency requests at least two days before the scheduled work.
- B. **UTILITIES.** No utility service such as water, gas, medical air and gas, steam, sewer, electric, fire protection or communication shall be interrupted without prior approval of the contact person. This includes those interruptions required by the contract. Construction contracts include provisions for maintaining utility systems or providing temporary facilities. Utility shutdowns shall be done on weekends. Requests for utility shutdowns shall reach the contact person at least 30 days before the scheduled work. Any EMERGENCY REQUIRING AN IMMEDIATE SHUTDOWN WILL BE REPORTED IMMEDIATELY to the contact person. The contact person will in turn immediately notify the Engineering Office

and the appropriate Chief, Facilities and Operations. The Contractor will prepare and forward to the Chief, Engineering Service, a written report of the situation, why it happened, a schedule of any further corrective work needed, and what, if any steps are being taken to prevent a recurrence.

- C. **INTERIM LIFE SAFETY MEASURES.** If a Fire Alarm system is out of service for more than 4 hours, or if a Sprinkler system is out of service for more than 4 hours, then this shall require the contractor to implement Interim Life Safety Measures in accordance with the latest issue of the VA Palo Alto Health Care System Memorandum SAFE 07-23.
- D. **PROTECTIVE CLOTHING/EQUIPMENT.** All workers will wear and/or use protective clothing and gear when required. This includes hard hats, goggles, protective shoes, gloves, masks or breathing apparatus, etc. The Contractor shall provide and protective equipment that may be required.
- E. **TELEPHONES.** Contractors may provide their own telephone, or pay telephones are available at many locations throughout the VA Palo Alto Health Care System for public use including contractors and the contract workers. Government telephones will not be used for private business or personal calls. Contractors or their workers may use the Government telephones to call/page the contact person, the Engineering Service office, or when authorized by the contact person - to call their office concerning contract matters. Telephone calls for contract workers will not be accepted by the Health Care System.
- F. **ELEVATORS/CORRIDORS.** Contractors and workers may use corridors and elevators for travel to and from the job sites when in proper attire (shirt and shoes required) provided they don't track mud, wet cement or any form of "dirt" into the buildings. The contact person will assign specific routes, times and elevators to use for transportation of materials and equipment. The Contractor will clean-up any mess caused by their workmen. Smoking is prohibited in elevators and corridors. Elevators will not be used during an emergency.
- G. **TOILETS.** The Contractor is to provide their own toilet facilities, however, the contact person will advise the Contractor which toilet facilities (if available) may be used by the Contractor's workmen. The Contractor will ensure that the facilities are kept clean and will be responsible for any damage done by the Contractor's workers.
- H. **PARKING/TRAFFIC.** Specific parking areas may be assigned for workers on larger construction projects. Workers on smaller construction or maintenance contracts may use that is away from buildings if no parking area is designated. Contractors, including maintenance contractors and workers are specifically prohibited from parking in those spaces reserved for Engineering Vehicles or lawn areas. Further, the Contractor is not to "back in" the space.
- I. **DELIVERIES.** The contact person will assign routes for the delivery of materials and supplies to the job site. The Contractor or construction traffic will not block any Health Care

System road or street, walk or building egress without requesting approval in a timely manner.

- J. **LOADING/UNLOADING.** Building loading docks and landings may be used to load or unload construction materials when approved by the contact person. However, any vehicle left unattended for more than a few minutes may be cited by the Health Care System Police. Some areas may be reserved for Health Care System operations only during certain hours.
- K. **FEDERAL POLICE.** The Health Care System Police are Federal Police Officers with full authority to make arrests, investigate crime, and to issue citations. Citations issued for driving, parking violations or other offenses usually require an appearance in the Federal District Court and/or payment of a fine. FOR THE SAFETY OF PATIENTS speed limits, other driving and parking codes are strictly enforced.
- L. **LOCKED AREAS.** The Contractor is to coordinate access to locked areas with the contact person, including obtaining keys required for access to work sites. All buildings at the Health Care System are locked during other than normal work hours. When the Contractor has approval to work other than normal work hours, he will need to make arrangements for his workers to have access to job sites.
- M. **OPERATIONS AND STORAGE AREAS** will be confined to areas designated by the contract or approved in writing by the contact person or the Contacting Officer. The Government will not be responsible for any tools, equipment or materials left or stored on Government facilities, unless exceptions are provided in the contract.
- N. **CONSTRUCTION WASTE AND DEBRIS** will not be disposed of on station or in Health Care System trash containers or dumpsters. The Contractor may provide his own bin or dumpster, however, the use and location of such must be approved in writing by the contract person. Construction waste and debris will not be accumulated in corridors or other building areas where it might cause a fire or safety hazard.
- O. **RECREATIONAL FACILITIES** such as swimming pools, gym, tennis courts, etc. Are not to be used by Contractors or Contractor's workers. Contractors and workers, in proper attire, are permitted to use the canteen for breaks and lunch and to purchase incidentals in the Canteen Store.
- P. **DISPOSAL OF HAZARDOUS MATERIALS.** Several buildings at the VAPAHCS contain asbestos containing materials (ACM). Some typical types of materials found to contain ACMs are pipe insulation, transit wall panels, floor tile, linoleum backing, floor/roof mastics and others. Contractors are required to communicate this information to all of their employees and subcontractors that will be working at any of the VAPAHCS sites, and failure to do so could result in OSHA citation(s). **Contractors are also required to alert the VAPAHCS immediately in the event any known or suspected ACM is accidentally disturbed or will need to be disturbed before proceeding with work.** If not indicated in

the contract drawings, known locations of ACMs can be determined from the current VAPAHCS asbestos survey. Disposal of any hazardous or potentially hazardous materials in sanitary or storm sewer systems or on Health Care System grounds is strictly prohibited. Hazardous materials, such as asbestos materials, used cleaning solutions and other harmful chemicals shall be disposed of in accordance with State and/or local laws and regulations. In case of an accidental spill of hazardous materials, the contractor is expected to take immediate action to contain the spill and at the same time notify the C.O.T.R./Contracting Officer of the spill. Action should be taken to mitigate the situation until you receive direction from the VAPAHCS Quality Management personnel.

- Q. **WASH DOWN**. Washing leftover cement, plaster, paint, oil or grease, solvents, etc. Into any drains and the washing down of cement trucks or other delivery vehicles is strictly prohibited. **REPORT ANY ACIDENTAL SPILLS THAT MAY RUN INTO STORM DRAINS IMMEDIATELY TO THE ENGINEERING SERVICE AT EXTENSION 62468.** Even accidental spills, particularly those not immediately controlled or contained, may result in legal action by local or state authorities against the responsible parties.
- R. **REMOVAL OF GOVERNMENT PROPERTY**, including empty boxes, crates, wood, etc. is prohibited, except approved by the Chief, Supply Service. Contractors or vendors taking Government equipment off station for repairs will notify the contact person of such action. In most cases, a receipt will be required.
- S. **SEXUAL HARASSMENT** is strictly prohibited. This includes deliberate or unsolicited verbal comments or gestures of a sexual nature, unwelcome sexual advances, requests for sexual favors and/or other unwelcome verbal or physical conduct of a sexual nature.
- T. **DRUGS AND ALCOHOL**. Possession or use of non-prescription drugs or alcohol, including beer and wine, on the Health Care System grounds is strictly prohibited.
- U. **FIREARMS AND EXPLOSIVES**. Possession of firearms, ammunitions, explosive devices and any hand held item that may be considered an offensive weapon is strictly prohibited. This includes carrying such items in vehicles.
- V. **SMOKING POLICY**. Smoking is prohibited in all Health Care System Buildings particularly in corridors, elevators, offices and patient areas, except in designated areas.
- W. **LOST AND FOUND**. Any article or money found on the premises should be delivered immediately to the contact person or the Health Care System Police for safekeeping. Anyone losing an article or money should contact the Health Care System Police to determine if it has been turned in.
- X. **SMOKE/FIRE BARRIER PENETRATIONS**. Any penetrations to smoke or fire barrier walls, ceiling or floor slabs shall be properly sealed immediately. We recommend Hilti Fire Stop 601 or 635 for walls and ceilings and Hilti Fire Stop 657 for floor penetrations.



- Y. **WELDING AND OR BURNING**: Any person planning welding, cutting metal studs or other such burning operations will obtain a burning permit from the Occupational Health and Safety Office, extension 65894. Welding and/or burning operations are allowed only during normal working hours.
- Z. **LOW VOLTAGE CABLE INSTALLATION**: The contractor shall install low voltage cable in raceways only after scheduling the work with the contact person. Whenever feasible, low voltage cables to be in the ceiling will be installed before the ceiling tile is installed.
- AA. **OCCUPATIONAL HEALTH AND SAFETY**: Contractors and their employees are expected to comply with and are subject to applicable OSHA and CAL-OSHA regulations as at any construction site.
- BB. **INJURY ACCIDENTS**: The Health Care System does not have the equipment, facilities, or personnel trained to handle serious injuries. Call 911 from a pay phone (or use an outside line) for emergency medical assistance and notify the contact person and the Health Care System Police.
- CC. **DAMAGE TO GOVERNMENT PROPERTY** caused by the Contractor or his workmen, whether accidental or incidental to the work, shall be corrected immediately at the Contractor's expense. This includes damage to lawns, shrubbery, irrigation systems, curbs, etc. Caused by construction vehicles/traffic and other operations.
- DD. **DUST AND FUME CONTROL** will be exercised on all construction operations. Workers will be careful not to operate any vehicles, gas or diesel engines, or to perform any fume or dust generating process near a building intake system.
- EE. **NOISE** will be held to a minimum at all times. Jack-hammering, core drilling and other noisy or disturbing operations may have to be rescheduled (or accomplished after hours) to avoid interfering with surgery or other programs. OSHA standards related to decibels are a requirement in any event.
- FF. **ROADS & WALKS**. Any debris dropped along egress from the station will be cleaned up immediately. Mud and dirt on roads and walks will be cleaned up as soon as the construction operation is complete or at the end of each day.
- GG. **FIRE SAFETY PRECAUTIONS** Contractors are expected to comply with all fire safety precautions. In the event of a fire or during regular fire drill, the contractor must vacate the construction site within the zone affected.

- - - E N D - - -

**Attachment B:**

**Utility Shutdown Procedures - VAPAHCS Memo 138-08-14**

**Attachment C:**

**Sign-in/Acknowledgement Sheet for Utility Shut-Downs.**

**Attachment D:**

**Acceptable Construction Fencing Types.**

**Attachment E:**

**Site Safety Review Checklist**

## Veteran Affairs Palo Alto Health Care System (VAPAHCS)

## Construction Site Safety Review Checklist

Project: \_\_\_\_\_ Date: \_\_\_\_\_

Contractor: \_\_\_\_\_ Certifier Signature: \_\_\_\_\_  
 \_\_\_\_\_ Time: \_\_\_\_\_

All Contractor personnel and Subcontractor employees are responsible to conduct work activities in a safe and healthful manner for their health and well-being as well VAPAHCS personnel. The purpose of this Site Safety Review is to increase the Contractor/Subcontractors awareness of the need for safe work habits and a positive attitude toward loss prevention and control. Below columns marked with "NC" answers require the Contractor/Subcontractors implementation of corrective action plans. Additional comments/actions will be described on additional pages to supplement this report.

Safety & Health General	OK	NC	N/A	Concrete Operations	OK	NC	N/A
1. Safety Program / Injury Illness Protectn Plan				50. Cement/Silica dust exposures			
2. Orientation/Code of Safe Practices				51. Cutting Sawing/Grinding Controls			
3. Toolbox Meetings/Pre-Job Safety				52. PPE utilized by Crew			
4. Postings (OSHA) (Project Info/POC)				53. Wall or Structure Supported			
5. Emergency Numbers/First Aid				54. Pumps/equipment set-up/ cond.			
6. Toilets/ Hand Wash/Drinking Water				<b>Ladders</b>			
<b>Environment</b>				55. Ladder Conditions			
7. Ventilation, incl negative air/HEPA filtration				56. 3' Above Landing			
8. Illumination				57. Braced & Tied			
9. Integrity of Dust Control and containment				58. A-Frame Step Ladder Set Up			
10. Openings Guarded/Covered-Marked				59. Correct Height			
11. Stairs/Walkways Guarded & Accessible				60. Proper Use			
12. Rebars Capped				<b>Scaffolds/Shoring</b>			

				<b>(Interior/Exterior)</b>			
13. Equipment/Material Storage				61. Current certified installation doc			
14. Traffic/Public Safety				62. Planks/toe boards			
15. 2 hr. fire separation from Patient Care Areas				63. Railed Properly			
16. Construction Warning Signs Posted				64. Tied to Structure			
17. Housekeeping				65. Ladder Access			
18. Emergency Exits – Clear / Unlocked				66. Daily Inspections			
19. ILSM in place – Exits Blocked/Locked				67. Users trained/Competent person			
<b>Electrical Safety</b>				68. Falling Object Protection			
20. Cords, Plugs Conditions, Surge Protectors				<b>Excavations/Trench</b>			
21. GFI Boxes & Grounding				69. Daily Inspections/Competent Person			
22. Overhead Lines protected/marked/spotter				70. Shored/sloped > 5' or soil cond.			
23. Lock out Tag Out				71. Spoil Piles at least 2' from edge			
24. Power/Generator/breaker panels secured				72. Underground Line located/potholed			
<b>Personal Protection (PPE)</b>				73. Barricades/protective measures			
25. Hard Hats				74. Ladder every 25' & after 4' deep			
26. Eye & Face Protection				<b>Vehicle/Equipment Operations</b>			
27. Ear Protection				75. Seat Belts by Operators			
28. Gloves/Clothing				76. Back Up Alarms – all Equipment			
29. Footwear				77. Reflective garments/PPE			
30. Respiratory (Dust/Canister Masks)				78. Personal cars in designated areas			
<b>Site Security</b>				79. Forklift operators trained			
31. Fencing				80. Flagmen/Traffic Control			
32. Security				<b>Scissors/Zoom Booms/Lift</b>			

				<b>Trucks</b>			
33. Entrance/Exit				81. Controls Operative			
<b>Hand/ Power/Powder Actuated Tools</b>				82. Safety Chains in Place			
34. Guards attached/functional				83. Harness & Lanyards (JLG's)			
35. Grounded Properly				84. Operator Certification			
36. Working Properly				85. Visual Inspection			
37. Trained or Certified Operators/PPE				86. Fluid Levels (Oil, Water)			
<b>Fire Protection</b>				87. Brakes/Lights/Back up Alarm(s)			
38. Fire Extinguishers checked/accessible				88. Gauges – Operative			
39. Alarm/Detection System in Place				89. Scheduled Maintenance			
40. Smoking (No Smoking)				<b>Welding &amp; Cutting</b>			
41. Hot Work Permits approved/current				90. Approved Hot Work Permit			
42. Flammable/Combustible Material				91. Cylinders – Use & Segregation			
<b>Fall Protection</b>				92. Torches,Horses,Gauges,PPE,etc			
43. Use of Fall Protection above 6'				93. Weld Cables, Holders & Grounds			
44. Floor openings/holes securely covered				94. Fire Protection (Task Work)			
45. Perimeter/Interior Shaft Guardrails				<b>Personnel Hoists &amp; Cranes</b>			
46. Falling material/objects				95. Inspections & Maintenance			
47. Trained on Use – Competent Person				96. Crane Set Up & Swing Protection			
48. Handrails for stairs 4 or more steps				97. Rigging & Loads Secured			
49. Fall Protection Equipmt in place/Inspected.				98. Certified Operator			

Legend: OK = Practice in Compliance; NC = Needs Correction -- Identify ID number & correction needed on back of sheet; N/A = Not Applicable



**Attachment F:**

**ILSM (Interim Life Safety Measures) Matrix & Sample Matrix**

**Attachment G:**

**VAPAHCS Codes of Practice for Tel/Data Cabling Installations**

**Office of Information and Technology DESIGN AND CONSTRUCTION GUIDANCE  
(revised 3/8/11)**

**1. General VA Palo Alto Health Care System**

**1.1 Codes of Practice**

Adherence to **the** VA Network Cable Specifications by cabling installation contractors is a condition of contract. In the event the cabling installation is sub-contracted by the prime contractor, the prime contractor will supply a copy of these specifications to the sub-contractor. This requirement shall cover all levels of sub-contracting.

Any variations to the issued job specification shall be referred for approval to the Contracting Officer Technical Representative (COTR).

Contractors shall install all cable and cabling products with a proven track record for data network cabling installations. Such installations shall also meet all requirements as set out in this specification.

Un-terminated "future capacity" cables are not permitted. All installed cables shall be terminated at each end and documentation, labeling and (where applicable) test results provided. This applies to all permanently installed cable types.

## **1.2 Documentation**

At least two copies of documents describing the data cable installation shall be provided.

A copy to be supplied to the COTR for approval

## **1.3 Network Equipment**

COTR must approve the installation or removal of network hardware equipment. Non-VA staff shall carry out such work only with prior approval from the COTR.

## **1.4 Network Equipment Environment**

Punch down area(s) (location of the data communication rack(s)) will be determined by the building Architect/Engineer and the COTR.

Contractor shall supply at minimum 1000BaseT, Category 6 certified rack-mounted modular RJ45 HIGH DENSITY patch panel (24/48 ports) for jacks meeting the ANSI/EIA/TIA t568-B- category 6 standards.

Contractor shall supply at minimum 1000BaseT, Category 6 certified AT&T style 110 blocks for voice requirements meeting the ANSI/EIA/TIA t568-B- category 6 standards. Contractor shall install one full wall of fire-rated plywood for the 110 blocks to be mounted on.

Contractor will supply contract specified number of 19"W x 84"H steel data communication rack. Both racks shall have a grounding wire and bus bar installed to earth ground.

Each jack on the AT&T style 110 block and HIGH DENSITY rack mountable patch panel will correspond with the jack at the wall device faceplate.

Where network equipment is to be located in a secure room or large closet, the room or closet shall have a dry powder extinguisher, suitable for electrical fires, provided and installed within the room. Air conditioning is required in each IT room. And the OI&T key core should be installed.

## **2. Unshielded Twisted Pair (UTP) Category 6 \*Contractor shall use a Cable color other than White \***

IEEE 802.3 100BaseT UTP Level 6, 24 AWG plenum rated cable.

Insulation - high-speed data grade.

Sheath - high temperature UL data grade.

### **2.1 Network Configuration Constraints \* Contractor shall use a Cable color other than White \***

Each segment comprises a four pair Category 6 cable.

Pin all 8 conductors.

Maximum link length - 90 meters

Maximum channel length - 100 meters

Maximum number of stations per segment - 1.

## **2.2 Installation Constraints**

### **2.2.1 Installation Standards**

Cable and connecting hardware meeting or exceeding the Category 6 specifications shall be used throughout, with pairs terminated according to the T568B wiring scheme.

### **2.2.2 General Requirements**

The cabling system shall include all patch panels, horizontal cables, transition blocks, vertical cabling, modular jacks, system cables, patch cables, cable management, and a comprehensive labeling system. Cable trays shall be installed in main hallways in the place of j-hooks.

### **2.2.3 Data Outlets**

The following information represents a minimum requirement for the number of UTP outlets that shall be installed in each type of workspace.

If the construction at the location of the voice/data outlet is drywall, provide flush-mounted single-gang outlet boxes with six-port base plates and applicable wall device faceplates (cable to be installed behind drywall).

If the construction at the location of the voice/data outlet is a solid wall, provide surface-mounted single-gang outlet boxes with six-port base plates and applicable wall device faceplates (cable to be installed in plastic wall mold equipped with protective insulator or sleeve).

Where modular furniture is used, the location of the voice/data outlet will be in the baseboard of the furniture, where the networked equipment (computers, printers, etc) will be located. Provide flush-mounted single gang outlet boxes with six-port base plates and applicable wall device faceplates. If flush-mounted single-gang outlet boxes cannot be used, then modular surface mount boxes will be used with six-port inserts. All cable runs in modular furniture will be through furniture wire baseboard ducts/conduit.

### 2.2.4 Horizontal Cabling

The horizontal wiring shall be a star topology connecting each network outlet jack to a jack on a patch panel rack in a communications enclosure/room.

The cable used shall be 4-pair 100-ohm high performance, 24 AWG solid conductor, and unshielded twisted pair cable, meeting or exceeding the Category 6 specification.

### 2.2.5 Network Outlet and Labeling

**\*ETHERNET 568B .5 RJ 45 shall be blue and .6 RJ 45 shall be yellow \***

**\*VOICE Pair one in insert one shall be white and Pair two in insert two shall be white**

Each network outlet faceplate shall incorporate one or more modular, universal RJ45 IDC jack sockets meeting or exceeding the Category 6 specification. Label each jack at this wall device faceplate to correspond with the label on the patch panel jack (N1, N2, etc.). All numbering should be readily visible.

### 2.2.6 Cable Installation

The cable interconnecting a network outlet to the patch panel shall be one continuous length with no intermediate joins, splices or taps. Each cable runs shall be no longer than 300 feet total in length, from start to finish.

Cable termination onto a horizontal distribution panel or patch panel shall be undertaken in a manner that permits additional cables to be terminated without unduly disturbing previously installed cables.

Each voice/data outlet / device location will have three (3) cable runs. One (1) will terminate on the AT&T style 110 block for voice requirements and two (2) will terminate on the high density rack mounted patch panel.

No more than 24 cables shall be cable tied in a bunch.

A 2-meter loop of cable shall be left within or on the approach to each communications room/enclosure to facilitate re-termination of the cable in the future, should this be required. Such cable slack shall be coiled and supported in a neat and practical manner.

A 0.5-meter loop of cable shall be left in the trunking on the approach to each network outlet to facilitate re-termination of the cable in the future, should this be required.

The amount of untwisting in a pair as a result of termination to connecting hardware shall be no greater than 13mm, and less than this if possible.

Cable bend radii shall be no less than eight times the cable diameter or as specified by the cable manufacturer; whichever is the greater.

Precautions shall be observed to eliminate cable stress caused by tension in suspended cable runs and tightly strapped bundles.

Cable bundles shall not rub on, or be unduly compressed against any cable tray, equipment racking, or other cable support.

Cable bundles shall not obstruct the installation and removal of equipment in equipment racks.

Where UTP cables are run parallel with electrical cables the following minimum separation rules shall be observed:

<u>Circuit rating</u>	<u>Unshielded power/data</u>	<u>Shielded power/data</u>
$\leq 1$ KVA	300mm	25mm
$\geq 1 < 2$ KVA	450mm	50mm
$\geq 2 < 5$ KVA	600mm	150mm
5 KVA	1500mm	300mm

Where UTP cables are run in the proximity of electrical motors or transformers the minimum separation shall be 1 meter.

In situations where the above minimum distances cannot be applied due to a lack of available space, data cables shall be enclosed in rigid and/or flexible steel conduit. Conduit shall be bonded to a protective ground at one point in the installation. No steel cabling enclosure medium shall be installed without having continuity to a protective ground.

### 2.3 Inter-Building Cabling

#### **Wiring Maintenance or other local buildings:**



If local network connectivity for Maintenance or other local buildings is required, follow all specifications as stated in this document.

Connecting Maintenance or other local buildings with the Administration Building:

If the distance between the punch down area in the Administration Building to the punch down area in the Maintenance Building does not exceed 100m or 328' (maximum length of the cable run), then 1000BaseT UTP Level 6 24AWG plenum 4 pair cable may be used. Two cables will be required and must be installed in direct buried conduit that will connect the two buildings.

If the distance to the punch down area in the Maintenance Building exceeds 100m / 328' but is no more than 2km / 1.24 miles (maximum length of the cable run). Cable should be routed as shown on the contract drawing. All feeder and riser copper cabling shall be terminated on 110 blocks and associated protectors shall be installed according to ansi/eia/tia standards/nec.

If the distance to the maintenance building exceeds 2km / 1.24 miles but is no more than 5km / 3.10 miles, then single-mode fiber 8x125 microns is recommended.

The contractor will install LC connectors at both ends of the SM fiber. A minimum of 12 SM strands will be required and must either be installed in conduit and/or installed below the frost line, however, it is highly recommend the cable be installed in conduit. All bends will be made with long radius conduit. All associated fiber patch panels shall be installed by the contractor.

Below is a list of hardware that is required if fiber is installed. VA will supply the Cisco Catalyst Switch for installation by the contractor on an approval basis. Contact the COTR to arrange delivery.

Single-mode

-----

Cisco Catalyst 3750-48 port

Cisco Catalyst LX uplink port

Single-mode Fiber 8.3x125 microns

LC Connectors

## **2.4 Testing**

Testing shall be carried out with building electrical services operating (lighting, power, air-conditioning plant and lift services where applicable).

Wiring shall be tested to verify the continuity, integrity and polarity of the cable according to the specified pin and pair grouping assignments.

## **2.5 Documentation**

The contractor shall provide installation documentation at the completion of the cabling system installation.

The contractor shall certify that the cabling system meets the UTP cabling system requirements for Category 6 performance levels.

## **3. Optical Fiber Cable (Ethernet)**

Single-mode Fiber

Core Diameter 7 - 9 microns

Cladding diameter 125 microns

Prim. Acryl. Buffer diameter 250 microns

Proof test not less than 50kpsi.

Numerical aperture 0.11

Attenuation not greater than 0.5dB/Km @ 1310nm. not greater than 0.4dB/Km @ 1550nm.

Termination: All Single-mode terminations shall be made with LC connectors

### **3.1 Fiber Network Configuration Constraints**

Maximum Single-mode segment length – 5 km

### **3.2 Installation Constraints**

Minimum bend radius (during installation)- not less than 20 X outside diameter of cable.

Minimum bend radius (as installed) - not less than 10 X outside diameter of cable or the manufacturer's specification, whichever is the greater.

During installation the pulling force shall not exceed the manufacturer's specified maximum.

Cable slack shall be provided as follows:

Within pits - 2 meters minimum.

At a termination location - 2 meters minimum.

Within a termination enclosure - 0.5 meter minimum.

All fiber cable terminations are to be LC connectors. When using a wall or rack mount enclosure, a patch cord protector shall be included in the installation.

### **3.3 Testing**

100% Insertion Loss (light source and power meter) testing of all terminated fibers shall be performed in both directions at 1310nm for single mode cables.

OTDR tests shall be performed at high wavelength, if the distance is greater than 1000m at 1550nm for single mode cables.

Optical loss covers the total loss between two corresponding optical ports and must include allowances for losses due to fiber, connectors, passive optical components, splices and any margin for maintenance. This loss shall not exceed 5db.

Copies of all test results are to be provided to the COTR on completion of the project.

### **3.4 Documentation**

Documentation of a cable installation shall comprise the following:

Cable type  
Route followed  
Pit locations (where applicable)  
Building names  
Table of losses for each core

**4. 0 In reference to VA Master Specification Section 27 15 00 Communications  
Horizontal cabling, the following shall be noted :**

Palo Alto EPBX has one in existence and it is located in Bldg 100 FB370.

Page 27 15 00- 24.

- e.1 2 Category 6 rj 11 to be installed
- f. Provide each rj45 type jacks

Page 27 15 00 -25. h. Fiber Optics. VA Palo Alto networking equipment does not support ST type – Provide LC terminations on both ends.

Page 27 15 00 -26. 2. SM fiber – Provide LC terminations.

Page 27 15 00 -29. 4.C Palo Alto no longer uses MM fiber due to the distance limitations. Provide Type SM. VA Palo Alto networking gear has been refreshed by OI&T in March 2009 for SM fiber uplinks.

Page 27 15 00 -29.5. Palo Alto purchases our own patch cables – this purchases is unnecessary.

Page 27 15 00 -34.

h.3 Indicates a clause for growth on Category 6 cabling which should be able to give VA Palo Alto the additional rj45 we are asking

h.4 Indicates a clause for distance on MM vs SM which should be able to give Palo Alto the SM fiber with LC connections we are asking for.

Fiber limitations are identified on Page 27 15 00-34. h..4 –Provide proof of testing of all fibers to VA Palo Alto IT.

The Contractor supply and install the IT equipment rack into each TC.

Provide the IT department with cable warranty and POC so VA Palo Alto can route any cable warranty issues directly with them. Industry standards are 10 years on cabling warranty.

Submit Contractor's telecommunications OEM certifications for the installers as mandated by 27 15 00-9 1.4.E.

Under clause 27 15 00-2 E, Contractor shall use cable tray for the horizontal cabling.

**Attachment H:**

**VAPAHCS Tel/Data Jack Conventions**

**Attachment I:**

**Project Construction Wall Flyer Notice - Sample**





## CONSTRUCTION AREA

ENGINEERING SERVICE has hired a construction contractor to (Project Title, Location) This project (Project Number) began in (Month and Year) and will continue until approximately (Month and Year).

**CONSTRUCTION HOURS:** 8:00 a.m. - 4:30 p.m.

For information regarding this project, contact

**CO's Name, Contracting Officer, x(Extension)**

**COTRs Name, Engineering Service, x(Extension)**

**Mary Barbara, Safety Officer, x65994.**

**Excuse our dust!**

**Attachment J:**

**Hot Work Program Requirements - VAPAHCS Memo SAFE-09-06**

**VA PALO ALTO HEALTH CARE SYSTEM**

**3801 Miranda Avenue**

**Palo Alto, CA 94304-1290**

**Effective Date: February 21, 2007**

**Issue Date: October 13, 2009**

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**HEALTH CARE SYSTEM MEMORANDUM No. SAFE-09-06**

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**SUBJECT: HOT WORK PROGRAM**

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1. **SUMMARY:** Veterans Affairs Palo Alto Health Care System (VAPAHCS) Memorandum No. SAFE-07-06, dated May 8, 2008, is rescinded. Minor changes have been made.

2. **PURPOSE:** To establish policy and procedures for cutting and welding and other hot work operations in nondesignated areas.

3. **POLICY:** All supervisors, employees, and contractors will take proper precautions when any cutting, welding, or other hot work is to be accomplished and assure all work is done in a safe manner with limited risk to patients, staff and visitors.

4. **DEFINITIONS:**

a. Hot Work: Hot work activities include welding, flame cutting, open-flame brazing or soldering, grinding, thermal spraying and/or other similar activities that generate sparks/heat that can provide an ignition source. The use of a portable engine for temporary power is also considered a hot work operation.

b. Fire Watch: An individual responsible for keeping an eye on the work area during the hot work process. The Fire Watch shall not be the same person actively performing the hot work.

5. **PROCEDURES:** Procedures and controls are established to control all cutting and welding operations conducted in areas not specifically designated for this type of operation. Permits will be authorized and issued by the Safety and Emergency Management (SAFE) Section in written form. Permits are not necessary when hot work is performed in Engineering shops designated for routine use of cutting and welding equipment.

a. When a hot work operation is necessary, SAFE will be contacted by the Contracting Officer's Technical Representative (COTR) or government employee. For major projects, the COTR should coordinate hot work requirements beforehand to preclude delay in contractor work.

b. When a permit is issued, Section A of the permit (Attachment A) will initially be completed by the SAFE Service.

c. Section B of the permit will be completed by the contractor or government employee requesting the permit and the permit will be maintained at the job site.

d. Section C on the permit will be completed by the supervisor or fire watch after the 30-minute inspection of the area has been completed.

e. When the operation is completed, and Section C of the permit is signed, it will then be forwarded to the SAFE Service where it will be maintained as a permanent record for a period of one year.

f. A Fire watch is required for all hot work unless specified differently on the permit. A fire watch is normally required in locations meeting the following conditions:

(1) Appreciable combustible material, in building construction or contents, closer than 35 feet (10.7 m) to the point of operation.

(2) Appreciable combustibles are more than 35 feet (10.7 m) away but are easily ignited by sparks.

(3) Wall or floor openings within a 35-foot (10.7 m) radius expose combustible material in adjacent areas including concealed spaces in walls or floors.

(4) Combustible materials are adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and are likely to be ignited by conduction or radiation.

g. The Fire watch shall have fire extinguishing equipment readily available and be trained in its use. They shall be familiar with facilities for sounding an alarm in the event of a fire. They shall watch for fires in all exposed areas, try to extinguish them or otherwise sound the alarm. A fire watch shall be maintained for at least 30 MINUTES after completion of welding.

**6. RESPONSIBILITIES:**

a. The Chief, Engineering Service is responsible for ensuring hot work permits are completed prior to hot work being conducted by contractors and staff under their purview.

b. The Facility Safety Officer, or authorized SAFE staff, will authorize and issue hot work permits when required and after assuring proper procedures have been put in place.

c. The COTR/Person requesting the Permit is responsible to insure that all required safety precautions as prescribed on the Hot Work Permit are complied with throughout the task.

**7. REFERENCES:**

a. NFPA 51B, Standard for Fire Prevention During Welding, Cutting and Other Hot Work, 1999 Edition.

b. OSHA 29 CFR 1910.119.

**8. RESCISSION DATE: October 31, 2012.**

9. **RESPONSIBLE OFFICIAL:** Chief, Safety, Emergency Management and Occupational Health Section.

Elizabeth Joyce Freeman

Director

Attachments (1)

ATTACHMENT A

## VA Palo Alto Health Care System

### HOT WORK PERMIT

**A. Safety & Emergency Management Service Completes**

Date: \_\_\_\_\_

Requester (Section or Company Name): \_\_\_\_\_

Building/Department/Floor: \_\_\_\_\_

COTR/Permit Requestor: \_\_\_\_\_

Description of work: \_\_\_\_\_

\_\_\_\_\_

Special Precautions (other than these listed): \_\_\_\_\_

\_\_\_\_\_

Permit expires on: \_\_\_\_\_

Authorized by: \_\_\_\_\_

Date/Time Issued: \_\_\_\_\_



**ATTACHMENT A (cont.)**

## **VA Palo Alto Health Care System**

### **HOT WORK PERMIT (cont.)**

#### **PRECAUTIONS**

- ☐ Sprinklers in service (Required for hot work).
- ☐ Cutting and welding equipment in good repair.

#### **WITHIN 35 FT. OF WORK**

- ☐ Floors swept clean of combustibles.
- ☐ Combustible floors wetted down, covered with damp sand, metal or other shields.
- ☐ No combustible material or flammable liquids present.
- ☐ Combustibles and flammable liquids protected with covers, guards or metal shields.
- ☐ All wall and floor openings covered.
- ☐ Covers suspended beneath work to collect sparks.

#### **WORK ON WALL OR CEILINGS**

- ☐ Construction noncombustible and without combustible covering.
- ☐ Combustibles moved away from opposite side.

#### **WORK ON ENCLOSED EQUIPMENT (Tanks, containers, drums, ducts, etc.)**

- ☐ Equipment cleaned of all combustibles.
- ☐ Containers purged of flammable vapors with an inert gas.

VAMC Palo Alto, CA

- - - E N D - - -

## Schedule

00 32 16.18  
SCHEDULE

## PART 1

- 1.01 APPROVED SCHEDULE: Within 10 calendar days after award, submit a Ghant chart progress schedule. Once this schedule is reviewed and approved it becomes the APPROVED SCHEDULE. The Notice To Proceed (NTP) shall not be issued until there is an APPROVED SCHEDULE. The Ghant chart shall show the complete sequence of construction by activity (including acquisition of materials and equipment). The Ghant chart shall identify the construction start date, the completion date, and all workdays through the duration of the project, a period of time shall be included at the end of construction for completion of the project Punch List. Each work activity, sub activity and equipment delivery shall be shown. The APPROVED SCHEDULE shall be used by the contractor for planning, organizing, directing the work, reporting progress and requesting payment for work accomplished. The government shall use the APPROVED SCHEDULE to determine if the contractor is ahead or behind schedule. The APPROVED SCHEDULE can only be modified with the Contracting Officers approval.

The requirement for an APPROVED SCHEDULE in no way precludes the contractor from developing and using other types of schedules, net work analysis or other project planning tools to accomplish this contract. The Construction Project Manager may at any time ask for any scheduling or planning document used by the contractor to be submitted.

- 1.02 SCHEDULE OF VALUES: Within 10 calendar days after the award, submit a schedule of values. Once this is reviewed and approved it will become the APPROVED SCHEDULE OF VALUES. This may be submitted in conjunction with the Ghant chart progress schedule. The Notice To Proceed (NTP) shall not be issued until there is an APPROVED SCHEDULE OF VALUES. There shall be a value provided for every work activity including materials and equipment on the APPROVED SCHEDULE. This shall total 80% of the award amount.

A brief description of each work activity shall be provided. This description shall provide enough information so as to determine what the work activity consists of so as to be able to determine when the work activity has been completed.

- 1.03 PERIODIC PAYMENTS: Periodic payments shall be approved only for work activities that have been 100% completed and for equipment and materials that has been delivered. Payments for General Conditions, 10% of the award amount, shall be divided by the number of months in the duration of the contract and paid as a percentage each month. A payment of 5% of the award amount shall be paid upon completion of the Punch List items. The final payment shall be paid only after all as

Schedule

built drawings, manuals, any other required documentation and the release of claims are delivered to the Construction Project Manager.

- 1.04 MODIFICATIONS: If any contract modifications are made to this contract, the subject of the modification shall be treated as an additional work item. A revised Ghant chart schedule and schedule of values reflecting the modification shall be submitted for review and approval to become the new APPROVED SCHEDULE and APPROVED SCHEDULE OF VALUES. The new APPROVED SCHEDULE and APPROVED SCHEDULE OF VALUES and all subsequent documentation revering to them shall be clearly marked with "Revision #1", "Revision #2" and so on.

PART 2

Not Used.

PART 3

Not used.

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

**PART 1-GENERAL**

**1.1 RELATED WORK**

- A. Refer to Articles titled SPECIFICATIONS AND ATTACHMENTS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.

**1.2 DEFINITIONS**

- B. 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 referenced requirements. The following text refers to all items collectively as SUBMITTALS.

**1.3 SUBMITTAL PROCEDURES**

- A. 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:
  - 1. Satisfactory written evidence is presented to, and approved by Contracting Officer's Representative, that manufacturer cannot make scheduled delivery of approved item or;
  - 2. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - 3. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- B. 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.
- C. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer or other competent party, and action thereon will be taken by Contracting Officer's Representative on behalf of the Contracting Officer.

## Shop Drawings, Product Data and Samples

- D. 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.
- E. 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 Contracting Officer, 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.
- F. 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 Contracting Officer's Representative and Architect-Engineer or other competent party assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- G. Submittals must be submitted by Contractor. All document submittals shall be E-Mailed to the Construction Project Manager. Submittals of products shall be shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
  - 1. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates via E-MAIL.
  - 2. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via E-MAIL, 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.
    - a. 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

Shop Drawings, Product Data and Samples

- ASTM or Federal Specification Number as applicable and location(s) on project.
  - b. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- H. In addition to complying with the applicable requirements specified in preceding Paragraph G, 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 Construction Project Manager.
1. Laboratory shall furnish the Construction Project Manager 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 five 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 Contracting Officer's Representative and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
  5. Laboratory test reports shall be sent directly to Contracting Officer's Representative 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.
- I. 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.
- J. Approved samples will be kept on file by the Construction Project Manager at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where

## Shop Drawings, Product Data and Samples

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.

- K. 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, the original .dwg and a PFD version shall be submitted via E-MAIL.
  2. 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.
  3. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
  4. One digital 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 Architect-Engineer under one cover.
- L. Samples (except laboratory samples), shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to the Construction Project Manager.

**PART 2 - PRODUCTS**

Not Used

**PART 3 - EXECUTION**

Not Used

- - - E N D - - -



**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 AM - 3:00 PM

**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 <a href="http://www.aamanet.org">http://www.aamanet.org</a>
AAN	American Nursery and Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
AASHTO	American Association of State Highway and Transportation Officials <a href="http://www.aashto.org">http://www.aashto.org</a>
AATCC	American Association of Textile Chemists and Colorists <a href="http://www.aatcc.org">http://www.aatcc.org</a>
ACGIH	American Conference of Governmental Industrial Hygienists <a href="http://www.acgi.org">http://www.acgi.org</a>
ACI	American Concrete Institute <a href="http://www.aci-int.net">http://www.aci-int.net</a>
ACPA	American Concrete Pipe Association <a href="http://www.concrete-pipe.org">http://www.concrete-pipe.org</a>
ACPPA	American Concrete Pressure Pipe Association <a href="http://www.acppa.org">http://www.acppa.org</a>
ADC	Air Diffusion Council <a href="http://flexibleduct.org">http://flexibleduct.org</a>
AGA	American Gas Association <a href="http://www.aga.org">http://www.aga.org</a>
AGC	Associated General Contractors of America <a href="http://www.agc.org">http://www.agc.org</a>
AGMA	American Gear Manufacturers Association, Inc. <a href="http://www.agma.org">http://www.agma.org</a>
AHAM	Association of Home Appliance Manufacturers <a href="http://www.aham.org">http://www.aham.org</a>
AISC	American Institute of Steel Construction <a href="http://www.aisc.org">http://www.aisc.org</a>
AISI	American Iron and Steel Institute <a href="http://www.steel.org">http://www.steel.org</a>
AITC	American Institute of Timber Construction <a href="http://www.aitc-glulam.org">http://www.aitc-glulam.org</a>
AMCA	Air Movement and Control Association, Inc. <a href="http://www.amca.org">http://www.amca.org</a>
ANLA	American Nursery & Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
ANSI	American National Standards Institute, Inc. <a href="http://www.ansi.org">http://www.ansi.org</a>
APA	The Engineered Wood Association <a href="http://www.apawood.org">http://www.apawood.org</a>

ARI	Air-Conditioning and Refrigeration Institute <a href="http://www.ari.org">http://www.ari.org</a>
ASAE	American Society of Agricultural Engineers <a href="http://www.asae.org">http://www.asae.org</a>
ASCE	American Society of Civil Engineers <a href="http://www.asce.org">http://www.asce.org</a>
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers <a href="http://www.ashrae.org">http://www.ashrae.org</a>
ASME	American Society of Mechanical Engineers <a href="http://www.asme.org">http://www.asme.org</a>
ASSE	American Society of Sanitary Engineering <a href="http://www.asse-plumbing.org">http://www.asse-plumbing.org</a>
ASTM	American Society for Testing and Materials <a href="http://www.astm.org">http://www.astm.org</a>
AWI	Architectural Woodwork Institute <a href="http://www.awinet.org">http://www.awinet.org</a>
AWS	American Welding Society <a href="http://www.aws.org">http://www.aws.org</a>
AWWA	American Water Works Association <a href="http://www.awwa.org">http://www.awwa.org</a>
BHMA	Builders Hardware Manufacturers Association <a href="http://www.buildershardware.com">http://www.buildershardware.com</a>
BIA	Brick Institute of America <a href="http://www.bia.org">http://www.bia.org</a>
CAGI	Compressed Air and Gas Institute <a href="http://www.cagi.org">http://www.cagi.org</a>
CGA	Compressed Gas Association, Inc. <a href="http://www.cganet.com">http://www.cganet.com</a>
CI	The Chlorine Institute, Inc. <a href="http://www.chlorineinstitute.org">http://www.chlorineinstitute.org</a>
CISCA	Ceilings and Interior Systems Construction Association <a href="http://www.cisca.org">http://www.cisca.org</a>
CISPI	Cast Iron Soil Pipe Institute <a href="http://www.cispi.org">http://www.cispi.org</a>
CLFMI	Chain Link Fence Manufacturers Institute <a href="http://www.chainlinkinfo.org">http://www.chainlinkinfo.org</a>
CPMB	Concrete Plant Manufacturers Bureau <a href="http://www.cpmc.org">http://www.cpmc.org</a>
CRA	California Redwood Association <a href="http://www.calredwood.org">http://www.calredwood.org</a>

CRSI	Concrete Reinforcing Steel Institute <a href="http://www.crsi.org">http://www.crsi.org</a>
CTI	Cooling Technology Institute <a href="http://www.cti.org">http://www.cti.org</a>
DHI	Door and Hardware Institute <a href="http://www.dhi.org">http://www.dhi.org</a>
EGSA	Electrical Generating Systems Association <a href="http://www.egsa.org">http://www.egsa.org</a>
EEI	Edison Electric Institute <a href="http://www.eei.org">http://www.eei.org</a>
EPA	Environmental Protection Agency <a href="http://www.epa.gov">http://www.epa.gov</a>
ETL	ETL Testing Laboratories, Inc. <a href="http://www.etl.com">http://www.etl.com</a>
FAA	Federal Aviation Administration <a href="http://www.faa.gov">http://www.faa.gov</a>
FCC	Federal Communications Commission <a href="http://www.fcc.gov">http://www.fcc.gov</a>
FPS	The Forest Products Society <a href="http://www.forestprod.org">http://www.forestprod.org</a>
GANA	Glass Association of North America <a href="http://www.cssinfo.com/info/gana.html/">http://www.cssinfo.com/info/gana.html/</a>
FM	Factory Mutual Insurance <a href="http://www.fmglobal.com">http://www.fmglobal.com</a>
GA	Gypsum Association <a href="http://www.gypsum.org">http://www.gypsum.org</a>
GSA	General Services Administration <a href="http://www.gsa.gov">http://www.gsa.gov</a>
HI	Hydraulic Institute <a href="http://www.pumps.org">http://www.pumps.org</a>
HPVA	Hardwood Plywood & Veneer Association <a href="http://www.hpva.org">http://www.hpva.org</a>
ICBO	International Conference of Building Officials <a href="http://www.icbo.org">http://www.icbo.org</a>
ICEA	Insulated Cable Engineers Association Inc. <a href="http://www.icea.net">http://www.icea.net</a>
\ICAC	Institute of Clean Air Companies <a href="http://www.icac.com">http://www.icac.com</a>
IEEE	Institute of Electrical and Electronics Engineers <a href="http://www.ieee.org/">http://www.ieee.org\</a>

IMSA	International Municipal Signal Association <a href="http://www.imsasafety.org">http://www.imsasafety.org</a>
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association <a href="http://www.mbma.com">http://www.mbma.com</a>
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. <a href="http://www.mss-hq.com">http://www.mss-hq.com</a>
NAAMM	National Association of Architectural Metal Manufacturers <a href="http://www.naamm.org">http://www.naamm.org</a>
NAPHCC	Plumbing-Heating-Cooling Contractors Association <a href="http://www.phccweb.org.org">http://www.phccweb.org.org</a>
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors <a href="http://www.nationboard.org">http://www.nationboard.org</a>
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association <a href="http://www.nema.org">http://www.nema.org</a>
NFPA	National Fire Protection Association <a href="http://www.nfpa.org">http://www.nfpa.org</a>
NHLA	National Hardwood Lumber Association <a href="http://www.natlhardwood.org">http://www.natlhardwood.org</a>
NIH	National Institute of Health <a href="http://www.nih.gov">http://www.nih.gov</a>
NIST	National Institute of Standards and Technology <a href="http://www.nist.gov">http://www.nist.gov</a>
NLMA	Northeastern Lumber Manufacturers Association, Inc. <a href="http://www.nelma.org">http://www.nelma.org</a>
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604
NSF	National Sanitation Foundation <a href="http://www.nsf.org">http://www.nsf.org</a>
NWWDA	Window and Door Manufacturers Association <a href="http://www.nwwda.org">http://www.nwwda.org</a>
OSHA	Occupational Safety and Health Administration Department of Labor <a href="http://www.osha.gov">http://www.osha.gov</a>

PCA	Portland Cement Association <a href="http://www.portcement.org">http://www.portcement.org</a>
PCI	Precast Prestressed Concrete Institute <a href="http://www.pci.org">http://www.pci.org</a>
PPI	The Plastic Pipe Institute <a href="http://www.plasticpipe.org">http://www.plasticpipe.org</a>
PEI	Porcelain Enamel Institute, Inc. <a href="http://www.porcelainenamel.com">http://www.porcelainenamel.com</a>
PTI	Post-Tensioning Institute <a href="http://www.post-tensioning.org">http://www.post-tensioning.org</a>
RFCI	The Resilient Floor Covering Institute <a href="http://www.rfci.com">http://www.rfci.com</a>
RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. <a href="http://www.rma.org">http://www.rma.org</a>
SCMA	Southern Cypress Manufacturers Association <a href="http://www.cypressinfo.org">http://www.cypressinfo.org</a>
SDI	Steel Door Institute <a href="http://www.steeldoor.org">http://www.steeldoor.org</a>
IGMA	Insulating Glass Manufacturers Alliance <a href="http://www.igmaonline.org">http://www.igmaonline.org</a>
SJI	Steel Joist Institute <a href="http://www.steeljoist.org">http://www.steeljoist.org</a>
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. <a href="http://www.smacna.org">http://www.smacna.org</a>
SSPC	The Society for Protective Coatings <a href="http://www.sspc.org">http://www.sspc.org</a>
STI	Steel Tank Institute <a href="http://www.steeltank.com">http://www.steeltank.com</a>
SWI	Steel Window Institute <a href="http://www.steelwindows.com">http://www.steelwindows.com</a>
TCA	Tile Council of America, Inc. <a href="http://www.tileusa.com">http://www.tileusa.com</a>
TEMA	Tubular Exchange Manufacturers Association <a href="http://www.tema.org">http://www.tema.org</a>
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 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
  - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Contracting Officer's Technical Representative to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Contracting Officer's Technical Representative for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
    - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
    - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
    - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
    - d. Description of the Contractor's environmental protection personnel training program.
    - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
    - f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
    - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
    - h. Permits, licenses, and the location of the solid waste disposal area.
    - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
    - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
    - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.

- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

#### 1.5 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.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including top soil, and land forms without permission from the Contracting Officer's Technical Representative.
  - 1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
  - 2. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
  - 3. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
    - a. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local 10 (design year) storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.
    - b. Reuse or conserve the collected topsoil sediment as directed by the Contracting Officer's Technical Representative. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING AND SOIL PREPARATION.
    - c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
  - 4. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features shown. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
  - 5. Manage borrow areas on Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
  - 6. Manage and control spoil areas on Government property to limit spoil to areas and prevent erosion of soil or sediment from entering nearby water courses or lakes.
  - 7. Protect adjacent areas from despoilment by temporary excavations and embankments.

8. 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.
  9. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
  10. Handle discarded materials other than those included in the solid waste category as directed by the Contracting Officer's Technical Representative.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
  2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
  3. Monitor water areas affected by construction.
- D. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of California, California Air Pollution Statute, Rule, Regulation and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
  2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
  3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
  4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- E. 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 Contracting Officer's Technical Representative. 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 local ordinance or the Contracting Officer's Technical Representative. 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 three 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 15 m (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
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS,	80	PNEUMATIC TOOLS	80
STATIONARY			
PUMPS	75		
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 five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the Contracting Officer's Technical Representative noting any problems and the alternatives for mitigating actions.

- F. 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.

- G. Final Clean-up: 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 Contracting Officer's Technical Representative. 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 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 (eg, 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 (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 8. Bitumen roofing materials.
  - 9. Plastics (eg, 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, 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 reuse and recycle new materials 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.cwm.wbdg.org> 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 Resident Engineer 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 job site waste to be generated:

- a. List of each material and quantity to be salvaged, reused, 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**

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, 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, invoices. Include the net total costs for each disposal.

VAMC Palo Alto, CA

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**SECTION 01 91 00  
GENERAL COMMISSIONING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 21, Division 22, Division 23 and Division 26 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.
- E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction, and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:
  - 1. Verify that the applicable equipment and systems are installed in accordance with the contact documents and according to the manufacturer's recommendations.
  - 2. Verify and document proper integrated performance of equipment and systems.
  - 3. Verify that Operations & Maintenance documentation is complete.
  - 4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.

5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
  6. Document the successful achievement of the commissioning objectives listed above.
- F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.
- G. The Commissioning Agent, both the firm and individual designated as the Commissioning Agent, shall be certified by at least one of the following entities: the National Environmental Balancing Bureau (NEBB), the Associated Air Balance Council Commissioning Group (AABC), and the Building Commissioning Association (BCA). Certification(s) shall be valid and active. Proof of certification(s) shall be submitted to the Contracting Officer and the Contracting Officer's Technical Representative (COTR) three (3) calendar days after the Notice to Proceed.
- H. All systems that require commissioning and have existing components shall be reviewed by the Commissioning Agent and the VA prior to construction to verify proper functioning. Any non-conforming functionality shall be resolved prior to construction.

## **1.2 CONTRACTUAL RELATIONSHIPS**

- A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the Contracting Officer's Technical Representative (COTR) as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer and the Contracting Officer's Technical Representative (COTR).
- B. In this structure, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Contracting Officer's Technical Representative (COTR) and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the Contracting Officer's Technical Representative (COTR) and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the Contracting Officer's Technical Representative (COTR).
- C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc) is essential to the success of the Commissioning effort.

- D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Contracting Officer and Contracting Officer's Technical Representative (COTR). Thus, the procedures outlined in this specification must be executed within the following limitations:
1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the Department of Veterans Affairs and the Contractor.
  2. Commissioning Issues identified by the Commissioning Agent will be delivered to the Contracting Officer's Technical Representative (COTR) and copied to the designated Commissioning Representatives for the Contractor and subcontractors on the Commissioning Team for information only in order to expedite the communication process. These issues must be understood as the professional opinion of the Commissioning Agent and as suggestions for resolution.
  3. In the event that any Commissioning Issues and suggested resolutions are deemed by the Contracting Officer's Technical Representative (COTR) to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or Contracting Officer's Technical Representative (COTR) will issue an official directive to this effect.
  4. All parties to the Commissioning Process shall be individually responsible for alerting the Contracting Officer's Technical Representative (COTR) of any issues that they deem to constitute a potential contract change prior to acting on these issues.
  5. Authority for resolution or modification of design and construction issues rests solely with the Contracting Officer or Contracting Officer's Technical Representative (COTR), with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

### **1.3 RELATED WORK**

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
- C. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.

### **1.4 SUMMARY**

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

## 1.5 DEFINITIONS

- A. Architect: Includes Architect identified in the Contract for Construction between the Department of Veterans Affairs and Contractor, plus consultant/design professionals responsible for design of fire suppression, plumbing, HVAC, controls for HVAC systems, electrical, communications, electronic safety and security, as well as other related systems.
- B. CxA: Commissioning Agent.
- C. Commissioning Plan: a document that is an overall plan that outlines the commissioning process, commissioning team responsibilities, schedule for commissioning activities, and commissioning documents.
- D. Commissioning Issue: a condition in the installation or function of a component, piece of equipment or system that affects the system operations, maintenance, and/or repair.
- E. Commissioning Observation: a condition in the installation or function of a component, piece of equipment or system that may not be in compliance with the Contract Documents, or may not be in compliance with the manufacturer's installation instruction, or may not be in compliance with generally accepted industry standards.
- F. Systems Functional Performance Test: a test, or tests, of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems Functional Performance Testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not Systems Functional Performance Testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while System Functional Performance Testing is verifying that the system has already been set up properly and is functioning in accordance with the Construction Documents. The Commissioning Agent develops the Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents the actual testing. Systems Functional Performance Testing is performed by the Contractor. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.



- G. System: A system is defined as the entire set of components, equipment, and subsystems 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 component of an entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam supply, chilled water supply, refrigerant supply, hot water supply, controls and electrical service, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of the fuel supply, combustion air, controls, steam, feedwater supply, condensate return and other related components.
- H. Pre-Functional Checklist: a list of items provided by the Commissioning Agent to the Contractor that require inspection and elementary component tests conducted to verify proper installation of equipment. Pre-Functional Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some Pre-Functional Checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The term "Pre-Functional" refers to before Systems Functional Performance Testing. Pre-Functional Checklists augment and are combined with the manufacturer's startup checklist and the Contractor's Quality Control checklists.
- I. Seasonal Functional Performance Testing: a test or tests that are deferred until the system will experience conditions closer to their design conditions.
- J. VA: Includes the Contracting Officer, Contracting Officer's Technical Representative (COTR), or other authorized representative of the Department of Veterans Affairs.
- K. TAB: Testing, Adjusting, and Balancing.

## 1.6 SYSTEMS TO BE COMMISSIONED

- A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.
- B. The following systems will be commissioned as part of this project:
  - 1. Plumbing (Division 22)
    - a. Domestic Hot Water systems (Confirm functionality of system prior to construction and confirm that entire system functions properly at end of construction).
    - b. Emergency Plumbing Fixtures (Water tempering valves, instruments and gages).

2. Electrical (Division 26)
  - a. Utility Service Entrance Switchgear (Fuses and circuit breaker settings, metering, mimic diagram, gages, and controls).
  - b. Normal Power Distribution Systems (Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  - c. Life Safety Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  - d. Critical Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  - e. Essential Equipment Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  - f. Lighting Controls (Control system hardware and software, scene settings, zone settings, occupancy sensor interface, and unoccupied cycle control).
3. Communications (Division 27)
  - a. Facility Telecommunications and Data Distribution Systems.
4. Electronic Safety and Security (Division 28)
  - a. Fire Detection and Alarm (Master panel and software, addressable units - i.e. pull stations, flow detectors, heat detectors, etc., controls and alarm functions, horns/bells/door releases and other output devices, mechanical systems shutdowns).

## **1.7 COMMISSIONING TEAM**

### **A. Members Appointed by Contractor:**

1. Contractor: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
2. Contractor's Commissioning Representative(s): Individual(s), each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent.

### **B. Members Appointed by VA:**

1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The VA will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

## **1.8 VA'S COMMISSIONING RESPONSIBILITIES**

- A. Appoint an individual, company or firm to act as the Commissioning Agent.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
  1. Coordination meetings.
  2. Training in operation and maintenance of systems, subsystems, and equipment.
  3. Testing meetings.
  4. Witness and assist in Systems Functional Performance Testing.
  5. Demonstration of operation of systems, subsystems, and equipment.
- C. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

## **1.9 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES**

- A. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.
- B. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.

- C. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
1. Participate in commissioning coordination meetings.
  2. Conduct operation and maintenance training sessions in accordance with approved training plans.
  3. Verify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
  4. Evaluate commissioning issues and commissioning observations identified in the Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with entity responsible for system and equipment installation, recommend corrective action.
  5. Review and comment on commissioning documentation.
  6. Participate in meetings to coordinate Systems Functional Performance Testing.
  7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Agent for incorporation into the commissioning plan.
  8. Provide information to the Commissioning Agent for developing commissioning plan.
  9. Participate in training sessions for VA's operation and maintenance personnel.
  10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

#### **1.10 COMMISSIONING AGENT'S RESPONSIBILITIES**

- A. Organize and lead the commissioning team.
- B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
- C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.
- D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.
- E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying

participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.

- F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.
- G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.
- H. Coordinate Systems Functional Performance Testing schedule with the Contractor.
- I. Witness selected systems startups.
- J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.
- K. Witness and document Systems Functional Performance Testing.
- L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
- M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00, GENERAL REQUIREMENTS.
- N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
- O. Prepare commissioning Field Observation Reports.
- P. Prepare the Final Commissioning Report.
- Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.
- R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

#### **1.11 COMMISSIONING DOCUMENTATION**

- A. Commissioning Agent's Certification(s): Commissioning Agent shall submit evidence of valid and current certification(s), as required in Section 1.1(G), to the Contracting Officer.

- B. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:
1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
  2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
  3. Identification of systems and equipment to be commissioned.
  4. Schedule of Commissioning Coordination meetings.
  5. Identification of items that must be completed before the next operation can proceed.
  6. Description of responsibilities of commissioning team members.
  7. Description of observations to be made.
  8. Description of requirements for operation and maintenance training.
  9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
  10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
  11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
  12. Preliminary Systems Functional Performance Test procedures.
- C. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:
1. Name and identification code of tested system.
  2. Test number.
  3. Time and date of test.
  4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
  5. Dated signatures of the person performing test and of the witness, if applicable.
  6. Individuals present for test.
  7. Observations and Issues.
  8. Issue number, if any, generated as the result of test.

- D. Pre-Functional Checklists: The Commissioning Agent will prepare *Pre-Functional Checklists*. *Pre-Functional Checklists shall be completed* and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check *Pre-Functional Checklists* to verify accuracy and readiness for testing. Inaccurate or incomplete *Pre-Functional Checklists* shall be returned to the Contractor for correction and resubmission.
- E. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.
- F. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results. Re-testing costs shall be borne by the Contractor.
- G. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.
1. Creating an Commissioning Issues Log Entry:
    - a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
    - b. Assign a descriptive title for the issue.
    - c. Identify date and time of the issue.
    - d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
    - e. Identify system, subsystem, and equipment to which the issue applies.
    - f. Identify location of system, subsystem, and equipment.
    - g. Include information that may be helpful in diagnosing or evaluating the issue.
    - h. Note recommended corrective action.
    - i. Identify commissioning team member responsible for corrective action.
    - j. Identify expected date of correction.
    - k. Identify person that identified the issue.
    - l. Identify issues in adjacent portions of building, outside the construction area, which may have been affected by construction activities.

2. Documenting Issue Resolution:
  - a. Log date correction is completed or the issue is resolved.
  - b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
  - c. Identify changes to the Contract Documents that may require action.
  - d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
  - e. Identify person(s) who corrected or resolved the issue.
  - f. Identify person(s) verifying the issue resolution.
- H. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:
  1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
  2. Commissioning plan.
  3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
  4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
  5. Commissioning Issues Log.
  6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.
- I. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:
  1. Documentation of deferred and off season test(s) results.
  2. Completed Systems Functional Performance Test Procedures for off season test(s).
  3. Documentation that unresolved system performance issues have been resolved.
  4. Updated Commissioning Issues Log, including status of unresolved issues.
  5. Identification of potential Warranty Claims to be corrected by the Contractor.



- J. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:
1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
  2. Reference to Final Commissioning Plan.
  3. Reference to Final Commissioning Report.
  4. Approved Operation and Maintenance Data as submitted by the Contractor.

## 1.12 SUBMITTALS

- A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:
1. The Commissioning Team: A list of commissioning team members by organization.
  2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
  3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
  4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
  5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.
  6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
  7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.
- B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.

- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.
- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.
- F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA Contracting Officer's Technical Representative (COTR) with copies to the Contractor and Architect.
- G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.
- H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.
- I. Data for Commissioning:
  - 1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
  - 2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

#### **1.13 COMMISSIONING PROCESS**

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.
- B. Within 7 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.

- C. Within 14 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

#### **1.14 QUALITY ASSURANCE**

- A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

#### **1.15 COORDINATION**

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling: The Contractor will work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. This should include confirmation that existing systems are functional. The Commissioning Agent will provide sufficient information on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.
- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.
- D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

- E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.
- F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

- A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.
- B. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 °C (1.0 °F) and a resolution of + or - 0.1 °C (0.2 °F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

## **PART 3 - EXECUTION**

### **3.1 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS**

- A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.
  - 1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.
    - a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
    - b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.

- c. Prior to construction, Commissioning Agent shall confirm with the VA that existing systems function properly.
- 2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.
  - a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
  - b. The full startup plan shall at a minimum consist of the following items:
    - 1) The Pre-Functional Checklists.
    - 2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
    - 3) The manufacturer's normally used field checkout sheets.
      - a) The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.
      - b) The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.
- 3. Sensor and Actuator Calibration
  - a. All field installed temperature, relative humidity, CO<sub>2</sub> and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 specifications.
  - b. All procedures used shall be fully documented on the Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
- 4. Execution of Equipment Startup
  - a. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
  - b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
  - c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
  - d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

### **3.2 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP**

- A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.
- B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.
- C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

### **3.3 PHASED COMMISSIONING**

- A. The project may require startup and initial checkout to be executed in phases. This phasing shall be planned and scheduled in a coordination meeting of the VA, Commissioning Agent, and the Contractor. Results will be added to the master construction schedule and the commissioning schedule.

### **3.4 TRENDING AND ALARMS**

- A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.
- B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers - Critical, Priority, and Maintenance.
  - 1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that is graphically linked to the associated unit's graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.
  - 2. Priority level alarms are to be printed to a printer which is connected to the Operator's Work Station located within the engineer's office. Additionally Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.
  - 3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report

automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.

- C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.
- D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the Contracting Officer's Technical Representative (COTR) and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:
  - 1. Pre-testing, Testing, and Post-testing - Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the Contracting Officer's Technical Representative (COTR). Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the Contracting Officer's Technical Representative (COTR), prior to the execution of Systems Functional Performance Testing.
  - 2. Dynamic plotting - The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.
  - 3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If this cannot be sufficiently accomplished directly in the Direct Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.
- E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified after submission shall be recorded and resubmitted to the Contracting Officer's Technical Representative (COTR) and Commissioning Agent.
  - 1. Point-to-Point checkout documentation;

2. Sensor field calibration documentation including system name, sensor/point name, measured value, DDC value, and Correction Factor.
3. A sensor calibration table listing the referencing the location of procedures to following in the O&M manuals, and the frequency at which calibration should be performed for all sensors, separated by system, subsystem, and type. The calibration requirements shall be submitted both in the O&M manuals and separately in a standalone document containing all sensors for inclusion in the commissioning documentation. The following table is a sample that can be used as a template for submission.

SYSTEM		
Sensor	Calibration Frequency	O&M Calibration Procedure Reference
Discharge air temperature	Once a year	Volume I Section D.3.aa
Discharge static pressure	Every 6 months	Volume II Section A.1.c

4. Loop tuning documentation and constants for each loop of the building systems. The documentation shall be submitted in outline or table separated by system, control type (e.g. heating valve temperature control); proportional, integral and derivative constants, interval (and bias if used) for each loop. The following table is a sample that can be used as a template for submission.

AIR HANDLING UNIT AHU-1				
Control Reference	Proportional Constant	Integral Constant	Derivative Constant	Interval
Heating Valve Output	1000	20	10	2 sec.

### 3.5 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

- A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.
- B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.



- C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.
- D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms developed by the Commissioning Agent will include, but not be limited to, the following information:
1. System and equipment or component name(s)
  2. Equipment location and ID number
  3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment.
  4. Date
  5. Project name
  6. Participating parties
  7. A copy of the specification section describing the test requirements
  8. A copy of the specific sequence of operations or other specified parameters being verified
  9. Formulas used in any calculations
  10. Required pretest field measurements
  11. Instructions for setting up the test.
  12. Special cautions, alarm limits, etc.
  13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
  14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
  15. A section for comments.
  16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.
- E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.

1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.
  2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
  3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
  4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.
  5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.
- F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.
- G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.
- H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

- I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.
- J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems will be checked.
- K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

### 3.6 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS

- A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.
- B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.
  - 1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.
  - 2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
  - 3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.

4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
    - a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will submit a Commissioning Field Report to the VA. The Commissioning Agent will also note items of noncompliance and the Contractor's response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.
    - b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.
  5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:
    - a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor's response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.
    - b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.
    - c. The Commissioning Agent will document the resolution process.
    - d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.
- C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:
1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
  2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall

include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
  4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
  5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be made later after review by the Commissioning Agent and by the VA. The Commissioning Agent will evaluate each test and report to the VA using a standard form. The VA will give final approval on each test using the same form, and provide signed copies to the Commissioning Agent and the Contractor.

### **3.7 DEFERRED TESTING**

- A. Unforeseen Deferred Systems Functional Performance Tests: If any Systems Functional Performance Test cannot be completed due to the building structure, required occupancy condition or other conditions, execution of the Systems Functional Performance Testing may be delayed upon approval of the VA. These Systems Functional Performance Tests shall be conducted in the same manner as the seasonal tests as soon as possible. Services of the Contractor to conduct these unforeseen Deferred Systems Functional Performance Tests shall be negotiated between the VA and the Contractor.
- B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for Deferred Seasonal Testing. The VA will review and approve the schedule for Deferred Seasonal Testing. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications.

### **3.8 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS**

- A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's Contracting Officer's Technical Representative (COTR), VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.

- B. The Contractor shall provide training and demonstration as required by other Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 sections. The Training and Demonstration shall include, but is not limited to, the following:
1. Review the Contract Documents.
  2. Review installed systems, subsystems, and equipment.
  3. Review instructor qualifications.
  4. Review instructional methods and procedures.
  5. Review training module outlines and contents.
  6. Review course materials (including operation and maintenance manuals).
  7. Review and discuss locations and other facilities required for instruction.
  8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
  9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
- C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:
1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.
  2. Qualification Data: Submit qualifications for facilitator and/or instructor.
  3. Attendance Record: For each training module, submit list of participants and length of instruction time.
  4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
  5. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.
    - a. Identification: On each copy, provide an applied label with the following information:
      - 1) Name of Project.
      - 2) Name and address of photographer
      - 3) Name of Contractor.
      - 4) Date videotape was recorded.
      - 5) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
  6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.
- D. QUALITY ASSURANCE
1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
3. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

E. COORDINATION

1. Coordinate instruction schedule with VA's operations. Adjust schedule as required to minimize disrupting VA's operations.
2. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
3. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the VA.

F. INSTRUCTION PROGRAM

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
  - a. Fire protection systems, including fire alarm, fire pumps, and fire suppression systems.
  - b. Intrusion detection systems.
  - c. Conveying systems, including elevators, wheelchair lifts, escalators, and automated materials handling systems.
  - d. Medical equipment, including medical gas equipment and piping.
  - e. Laboratory equipment, including laboratory air and vacuum equipment and piping.
  - f. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
  - g. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
  - h. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
  - i. switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
  - j. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
  - k. Lighting equipment and controls.
  - l. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
  - m. Site utilities including lift stations, condensate pumping and return systems, and storm water pumping systems.

G. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
  - a. System, subsystem, and equipment descriptions.

- b. Performance and design criteria if Contractor is delegated design responsibility.
  - c. Operating standards.
  - d. Regulatory requirements.
  - e. Equipment function.
  - f. Operating characteristics.
  - g. Limiting conditions.
  - h. Performance curves.
2. Documentation: Review the following items in detail:
- a. Emergency manuals.
  - b. Operations manuals.
  - c. Maintenance manuals.
  - d. Project Record Documents.
  - e. Identification systems.
  - f. Warranties and bonds.
  - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.



8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

H. Training Execution:

1. Preparation: Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual. Set up instructional equipment at instruction location.
2. Instruction:
  - a. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Department of Veterans Affairs for number of participants, instruction times, and location.
  - b. Instructor: Engage qualified instructors to instruct VA's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
    - 1) The Commissioning Agent will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
    - 2) The VA will furnish an instructor to describe VA's operational philosophy.
    - 3) The VA will furnish the Contractor with names and positions of participants.
3. Scheduling: Provide instruction at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with the VA and the Commissioning Agent with at least seven days' advance notice.
4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of **an oral, or a written**, performance-based test.
5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

I. Demonstration and Training Recording:

1. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
2. Video Format: Provide high quality color DVD color on standard size DVD disks.
3. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

4. Narration: Describe scenes on videotape by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

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**SECTION 02 41 00**  
**DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies demolition and removal of portions of buildings, utilities, other structures and debris from trash dumps shown.

**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. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.
- E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Construction Waste Management: Section 01 74 19, 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, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- E. 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 Technical Representative. 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 Contracting Officer's Technical Representative's approval.

F. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

G. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

#### **1.4 UTILITY SERVICES:**

A. Demolish and remove outside utility service lines shown to be removed.

B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 DEMOLITION:**

A. Completely demolish and remove portions of building as indicated on Drawings, including all appurtenances related or connected thereto, as noted below:

1. As required for installation of new utility service lines.
2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.

B. Debris, including brick, concrete, stone, 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 Contracting Officer's Technical Representative. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

C. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of Contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

- D. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer's Technical Representative. When Utility lines are encountered that are not indicated on the drawings, the Contracting Officer's Technical Representative shall be notified prior to further work in that area.

**3.2 CLEAN-UP:**

- A. On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Contracting Officer's Technical Representative. Clean-up 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 06 40 00  
ARCHITECTURAL WOODWORK**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies architectural woodwork items.
- B. Items specified includes but not necessarily limited to the following:
  - 1. Custom plastic laminate casework as detailed on the Drawings.
  - 2. Resin material for casework doors and panels.
  - 3. Wood veneer paneling with transparent finish.
  - 4. Wood handrails and brackets.
  - 5. Miscellaneous metal required for architectural woodwork items.
  - 6. Casework hardware.
  - 7. Architectural woodwork accessories.
  - 8. Aluminum channels, trims and reveals incorporated into architectural woodwork items.

**1.2 RELATED WORK**

- A. Solid surfacing: Section 06 61 16, SOLID SURFACING FABRICATIONS.
- B. Aluminum channel and patterned glass: Section 08 80 00, GLAZING.
- C. Resin panels installed in aluminum framing: Section 08 80 00, GLAZING.
- D. Color, finish and texture of plastic laminate and resin panels: Section 09 06 00, SCHEDULE OF FINISHES.
- E. Aluminum channels, trims and reveals incorporated into gypsum boards surfaces: Section 09 29 00, GYPSUM BOARD.
- F. Mechanical and electrical fixtures and fittings for elements located in casework, including rough-in and connection to such fixtures Section 22 40 00, PLUMBING FIXTURES and Section 26 51 00, INTERIOR LIGHTING.
- G. Electrical rough-in and connection to architectural woodwork section: Division 26, ELECTRICAL.

**1.3 DEFINITIONS**

- A. Exposed Surfaces: Visible surfaces of units when doors, drawers, or other closures are in closed position; visible exterior and interior surfaces of units without closures; visible surfaces behind clear glass doors; bottoms of units more than 4 feet above floor; closure fronts and edges; and countertops and splashes including their edges.
- B. Semi-Exposed Surfaces: Visible interior surfaces of units when doors are in open position; surfaces and edges of shelves; interior surfaces of doors and drawers; bottoms of wall hung units 1200 mm (4 feet) or less above floor; and tops of units 1650 mm (6 feet 6 inches) or more above floor.
- C. Concealed Surfaces: All surfaces other than exposed or semi-exposed as defined above.

#### **1.4 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Fabricator shall be equipped for and experienced in doing work including fabricating, finishing, and installing, equal to standards specified, and be able to provide evidence of such experience to the Contracting Officer's Technical Representative's satisfaction.
- B. Design Criteria:
  - 1. Casework shall be of the flush overlay design and, except as otherwise indicated, be of premium grade construction and of component thicknesses in conformance with AWS Section 10 CASEWORK.
  - 2. Exposed surfaces, semi-exposed surfaces, and concealed surfaces of wood casework shall be as defined in AWS Section 10 CASEWORK.
  - 3. Wood grades shall be as defined in AWS Section 3 LUMBER.
  - 4. Fastenings for securing casework to adjoining construction shall be as detailed on the drawings. Where type, size, or spacing of fastenings is not shown or specified, submit shop drawings for approval showing proposed fastenings and method of installation. See other sections of specifications for reinforcement of walls and partitions for casework anchorage. Casework shall not be anchored to wood ground strips.

#### **1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data.
- C. Samples:
  - 1. Plastic Laminate: Four samples of each color, 150 mm by 150 mm (6 by 6 inch), for color and pattern verification.
  - 2. Resin Material Panels: Four samples of each color, 150 mm by 150 mm (6 by 6 inch), for color and pattern verification.
  - 3. Wood Veneer: Four samples of specified wood, 150 mm by 150 mm (6 by 6 inch), apply specified factory finish to 2/3's of each sample.
  - 4. Wood Handrail: Three samples of specified wood, 300 mm (12 inches) long, apply specified factory finish to 2/3's of each sample.
  - 5. Other samples only as requested.
- D. Shop Drawings:
  - 1. Show fabrication, installation, and anchorage details.
  - 2. Show all details full size.
  - 3. Preliminary as well as final Shop Drawing submittals of items scheduled for WI conformance shall bear both "WI Certified Compliance Label" as well as the Contractor's approval stamp before the Contracting Officer's Technical Representative will consider drawings for review. AWI members may use AWI Grade Stamp.
- E. Certificates: Prior to delivery, furnish "WI Certified Compliance Certificates" certifying that products furnished fully meet all requirements of AWS grades specified.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver casework to job site only after proper facilities are available for handling, storing, and protecting items; receiving areas are broom cleaned; exterior openings are closed up; wet work and mechanical and electrical rough-ins are completed.

- B. Provide temporary protective covers for items during delivery, installation, and until final acceptance of project.

#### 1.7 JOB CONDITIONS

- A. Environmental Requirements:
  - 1. Finishing: Apply finishes under adequate lighting conditions and maintain temperature near 70 degrees F. during application.
  - 2. Provide proper heat and humidity in area of storage and installation to maintain equilibrium moisture content in wood until installation is completed. Relative humidity shall range from 50 percent to 65 percent at 70 degrees F.
- B. Sequencing: Provide information as required for proper placement of backing.
- C. Protection: Protect installation from damage until the Contracting Officer's Technical Representative's final acceptance.

#### 1.8 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):
  - A156.9-03.....Cabinet Hardware
  - A156.11-04.....Cabinet Locks
  - A156.16-02.....Auxiliary Hardware
  - HP-1983.....Hardwood and Decorative Plywood
- C. ASTM International (ASTM):
  - A36/A36M-08 ..... Structural Steel
  - A283/A283M-03(2007 ..... Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
  - B221-05a.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - D635-10.....Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
  - D1929-2.....Standard Test Method for Determining Ignition Temperature of Plastics
  - F436-04.....Hardened Steel Washers
- D. Federal Specifications (Fed. Spec.):
  - FF-B-561D.....Bolts, (Screw) Lag
  - FF-B-575C.....Bolts, Hexagon Square
  - FF-B-588C(1).....Bolts, Toggle; and Expansion Sleeve, Screw



FF-N-105B(1).....Nails, Brads, Staples And Spikes; Wire, Cut And  
Wrought

FF-N-836D.....Nut, Square, Hexagon Cap, Slotted, Castile,  
INT AMD 1 Knurled, Welding and Single Ball Seat

FF-P-395C.....Pin, Drive, Guided And Pin Drive, Power Actuated  
(Fasteners for Power Actuated And Hand Actuated  
Fastening Tools)

FF-S-111D(1).....Screw, Wood

FF-S-325.....Shield, Expansion; Nail Expansion; and Nail,  
INT AMD 3 Drive Screw (Devices, Anchoring, Masonry)

MM-L-736G.....Lumber, Hardwood

MM-L-751.....Lumber, Softwood

E. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 501.....Metal Finishes Manual, Finishes for Aluminum

F. National Electrical Manufacturer Association (NEMA):

LD3-1995.....High-Pressure Decorative Laminates

G. Woodwork Institute (WI):

AWS-2009.....Architectural Woodwork Standards

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

A. Basis-of-Design Products: The design of architectural woodwork is based on products specified in this Article. Subject to compliance with requirements, provide named product or a comparable product.

B. General Requirements:

1. Material Grades: AWS Premium Grade unless otherwise noted.
2. Lumber and plywood shall be kiln-dried to equilibrium moisture content suitable for fabrication in shop and suitable for use intended.
3. Plywood to be urea-formaldehyde free.

C. Wood Items:

1. Lumber Hardwood Concealed: Fed. Spec. MM-L-736.
2. Lumber Softwood Concealed: Fed. Spec. MM-L-751.
3. Wood Handrails: Match existing species and grain.

D. Wood Veneer for Transparent Finish:

1. Panel Core Material: Urea-formaldehyde free medium density fiberboard, made of material from Forest Stewardship Council (FSC) Certified forests. With Class A fire retardant rating.
2. Veneer Types: Refer to Section 09 06 00, SCHEDULE FOR FINISHES.

E. Base Material for Plastic Laminate:

1. Panel Core (Particleboard):
  - a. Description: A medium density mat-formed flat panel consisting of particles of wood bonded together with a urea-formaldehyde free synthetic resin or other suitable binder, compressed to proper density and cured under heat and pressure. Particleboard shall meet the requirements of ANSI A208.2, Class MD.
  - b. Product: SierraPine Limited's "Medite II"; Temple-Inland Inc.'s "TemStock-Free"; or equal.
2. Lumber (Solid Stock): Gum, Birch, or Sugar Pine.

F. Plastic Laminate:

1. Plastic Thickness and Grade: Meet requirements of NEMA LD3-1991.
  - a. Typical Horizontal Surfaces: 1.27 mm (0.050 inch), GP 50.
  - b. Typical Vertical Surfaces: 0.70 mm (0.028 inch), GP 28.
  - c. Typical Postforming Surfaces: 1.06 mm (0.042 inch), PF 42.
  - d. Cabinet Liners: 0.50 mm (0.020 inch), CL 20.
  - e. Balancing Sheets: 0.50 mm (0.020 inch), BK 20.
2. Adhesive for Laminating Plastic: As recommended by approved plastic laminate manufacturer.

G. Resin Material Panels (RS):

1. Description:
  - a. Engineered acrylic resin
  - b. Sheet Size: Maximum 4 feet by 10 feet
  - c. Thickness: Minimum 25 mm (1/2 inch).
  - d. Sheet minimum performance attributes:
    - 1) Rate of Burning (ASTM D635). Material must attain CC2 Rating for a nominal thickness of 1.5 mm (0.060 in.) and greater.
    - 2) Self-Ignition Temperature (ASTM D1929). Material must have a Self-ignition temperature greater than 850°F.
    - 3) Density of Smoke (ASTM D 843). 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. Product: 3form, Inc.'s "Chroma"; or architect approved equal.
3. Colors: Refer to Section 09 06 00, SCHEDULE OF FINISHES.
4. Related 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. Fasteners: Use screws designed specifically for plastics. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures.
  - d. Bonding Cements: May be achieved with solvents or adhesives, suitable for use with product and application.

H. Miscellaneous Steel Supports: Fabricate steel braces as welded assemblies of 2 inch tubing. Galvanize braces, at exterior, at kitchen, and at toilets.

1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
2. Architectural and Miscellaneous Steel Items: ASTM A283/A283M.
3. Steel plates to be bent or cold-formed: ASTM A283/A283M, Grade C.
4. Steel Tubing (Hot-Formed, Welded, Or Seamless): ASTM A501.

I. Fasteners:

1. Lag Bolts: Fed. Spec. FF-B-561.
2. Bolts with Nuts: Fed. Spec. FF-B-575 and FF-N-836.
3. Toggle Bolts: Fed. Spec. FF-B-588, Type I, Class A, Style 1.
4. Nails: Fed. Spec. FF-N-105, Type II, Style 6 or 14 for finish work.
5. Power Actuated Pins: Fed. Spec. FF-P-395.
6. Expansion Bolts: Fed. Spec. FF-S-325, Group II, type 1 or 2.
7. Screws: Fed. Spec. FF-S-111.
8. Washers: ASTM F436.

J. Wood Handrail Brackets: Match existing design, material, and finish.

K. Casework Hardware:

1. General Requirements:
  - a. Exposed Casework Hardware Finish: Satin nickel unless otherwise noted.
  - b. Furnish necessary screws, staples, bolts, or other fastenings of proper size and type to secure items in position and, where exposed, to match finish of hardware item fastened.
  - c. Provide locks at all doors and drawers.
  - d. Keying: Casework locks must use Best Lock Corp.'s "5E Keyway". Coordinate with the Contracting Officer's Technical Representatives for detailed keying instructions. Provide 2 keys for each lock. The name of the manufacturer, or trademark by which manufacturer can readily be identified, shall be legibly marked on each lock, and the key change numbers shall also be stamped on each key. Key change numbers shall provide sufficient information for replacement of the key by the manufacturer.
2. Pulls:
  - a. Description: Continuous extruded aluminum pull.
  - b. Product: Paramount Extrusions' "Kerf Mounted Pull"; or architect approved equal.
3. Drawer Extension Guides: Full extension side mounted guides, self closing; designed to prevent rebound when drawers are closed; epoxy coated steel complying with ANSI A156.9, B05091.
  - a. Products:
    - 1) Accuride:
      - a) Box Drawers: Model #3832 or 7432.
      - b) File Drawers: Model #4034.
    - 2) Knappe and Volt:
      - a) Box Drawers: Model #1429.
      - b) File Drawers: Model #8500.
    - 3) Or architect approved equal.
4. Hinged Doors: Matt nickel plated.
  - a. Pair Concealed Hinges, 1-1/2 pairs where more than 48 inches high: 176 degrees opening, self-closing type. ANSI A156.9, B01601.
  - b. Surface Slide Bolts (Use at locked pair of doors): ANSI A156.16, L04151, Mortise Strike.
5. Lock and Strike: ANSI A156.11, E07061, Grade 1.
6. Shelf Adjustment Clips: Shelf adjustment clips shall be powder coated to match cabinet/shelf finish.

L. Architectural Woodwork Accessories:

1. Grommets for Cable Passage through Countertops:
  - a. Product: Hafele America Co.'s Item No. 631.35.214 silver/aluminum RAL 9006 with brushed finish; or architect approved equal.
2. Cleats for Wall Panels: B & N Industries' "Panel Cleat"; or architect approved equal.

- M. Aluminum Channels, Trims and Reveals:
1. Material: Extruded aluminum, ASTM B221, alloy 6063-T5.
  2. Manufacturer: Fry Reglet Corp.; Pittcon Industries; or architect approved equal.
  3. Configurations: Dimensions and configuration as indicated on Drawings.
  4. Provide connector clips to align trim during installation.
  5. Aluminum Finish: NAAMM AMP 501.
    - a. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
- N. Factory Transparent Finishing Materials: As required to achieve finish system specified in this Section.

## **2.2 FABRICATION**

- A. Preparation:
1. Verify dimensions of receiving spaces at job site.
  2. Verify details and dimensions of equipment and fixtures integral with casework for proper fit and accurate alignment.
  3. Coordinate details with other work supporting, adjoining, or fastening to casework.
- B. General:
1. Fabricate casework as detailed on drawings and in accordance with AWS premium grade specifications unless otherwise noted.
  2. Shop fabricate and assemble complete work in complete units insofar as dimensions permit shipment and installation.
  3. Provide space at rear of casework where required for mechanical and electrical fittings.
  4. Provide cut-outs as required for mechanical, electrical, telephone, and toilet accessory installation.
  5. Do not expose fasteners except where noted. For exposed fasteners use Phillips flathead screws.
  6. Conceal nailing where possible and set nail heads for putty on exposed portions.
  7. Provide for concealed anchorage of tops and splashes.
- C. Custom Plastic Laminate Casework:
1. AWS Quality Grade: Premium.
  2. Construction Style: As indicated on the Drawings.
  3. All exposed and semi-exposed surfaces shall be plastic laminate surfaced.
  4. Coordinate fabrication with aluminum channel and patterned glass specified in Section 08 80 00, GLAZING.
- D. Casework Hardware:
1. Make provisions in accordance with approved hardware manufacturer's templates.
  2. Fit hardware to casework and attach for smooth, trouble-free nonbinding operation using hardware manufacturer's approved fasteners.
- E. Plastic Laminate:
1. Laminate plastic under pressure in accordance with WI requirements.
  2. Apply plastic laminate to all exposed and semi-exposed surfaces unless otherwise noted.
  3. Interior faces of drawers shall be covered with plastic laminate balancing sheet or cabinet liner.
  4. Interior faces of hinged doors shall be covered with plastic laminate cabinet liner.

5. Do not expose edges on face of casework.
6. Compensate laminate on 1 face of base material with laminate balancing sheet on opposite face.
7. Site application of plastic laminate shall be kept to a minimum.

F. Resin Material Panel Fabrication:

1. Fabricate to designs, sizes and thicknesses indicated and to comply with indicated standards.
2. Comply with manufacturer's written recommendations for fabrication.
3. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.
  - a. Sawing: Select equipment and blades suitable for type of cut required.
  - b. Drilling: Drills specifically designed for use with plastic products.
  - c. Routing.
  - d. Tapping.
4. Forming: Form products to shapes indicated using the appropriate method listed below. Comply with manufacturer's written instructions.
  - a. Cold Bending.
  - b. Hot Bending.
  - c. Thermoforming: Acceptable only on uncoated material.
  - d. Drape Forming.
  - e. Matched Mold Forming.
  - f. Mechanical Forming.
5. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.

G. Wood Handrails:

1. AWI Premium Grade.
2. Fabricate in one piece and one length when practical.
3. Fabricate curved sections for ends of rails to return to wall and where rails change slope or direction.
4. Joints are permitted only where rail changes direction or slope, or where necessary for field erection or shipping.
5. Scarf or dowel all joints to provide a smooth and rigid connection. Glue all joints.
6. Fit joints, to produce a hair-line crack.
7. Completely shop fabricated in accordance with approved shop drawings.

**2.3 FACTORY (SHOP) FINISHING**

- A. Factory finish architectural woodwork in accordance with AWS Premium grade or better unless otherwise noted.
- B. Factory Conditions: Apply finishes under adequate lighting conditions and maintain temperature near 70 degrees Fahrenheit during application.
- C. Preparation:
  1. Thoroughly hand-sand wood surfaces.
  2. Eliminate evidence of cross-sanding by final sanding in direction of grain.
  3. Ease knife-edge corners by sanding.
  4. Verify surfaces are dry, free from dust, glue stains, and other foreign matter, and in proper condition to receive finish.
- D. Transparent Finishing System:
  1. Wood Paneling: AWS System 3 Lacquer, Postcatalzed.
  2. Wood Handrails: Match existing finish.

E. Application:

1. Finish casework exteriors, interiors, and drawers.
2. Ensure no evidence of finish materials is present on hardware after final building clean-up with exception of prime-finished hardware attached for finish painting. Contractor may achieve this result by sequencing hardware attachment, removal after first fitting, protecting, cleaning to original hardware finish, or taking other recommended measures.
3. Do not apply finish over preceding coat unless preceding coat is completely dry.
4. Sand finish between coats.
5. Give free-to-warp components sufficient number of equal coats of finishing material on opposite sides and edges to preserve balance.
6. Wherever complete and satisfactory coverage is not obtained by number of coats specified, apply additional coats until complete, uniform coverage is obtained.
7. Ensure completed work is even, uniform, and clean.

**2.4 SOURCE QUALITY CONTROL**

- A. Inspection: Maintain phases of shop fabrication open to inspection by the Contracting Officer's Technical Representative.
- B. Grade Compliance: Arrange for and pay costs of WI inspections and obtain "WI Certified Compliance Label" on each casework item indicating grade specified. AWI members may use AWI Grade Stamp.

**PART 3 - EXECUTION**

**3.1 INSPECTION**

- A. Examine areas scheduled to receive casework for conditions that will adversely affect installation.
- B. Do not install items before unsatisfactory conditions have been corrected.
- C. Obtain Contracting Officer's Technical Representative's approval before installation.

**3.2 INSTALLATION**

- A. Install architectural woodwork and custom wood casework in accordance with AWS Premium Grade standards and reviewed Shop Drawings.
- B. Set work square, level, and plumb with edges scribed accurately and secure in place with fastenings, clips, braces, anchors, shims, and blocks.
- C. Coordinate architectural woodwork and custom casework items with partition construction for the placement and installation of items fastening to partitions.
- D. Exposed soffits of wall hung cabinets and toe spaces of bases shall be closed flush.

**3.3 CLEANING AND ADJUSTING**

- A. Remove damaged, soiled, or otherwise disfigured portions and replace with new prior to final acceptance.

- B. Wash finished work in strict accordance with product manufacturer's directions and ensure that washed surfaces do not differ from clean unwashed portions. Any difference will be considered unsatisfactory work.

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**SECTION 06 61 16**  
**SOLID SURFACING FABRICATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies solid surfacing (SF) fabrications and related accessories.
- B. Solid polymer surfaces includes:
  - 1. Countertops.
  - 2. Sinks integral with countertops
  - 3. Backsplashes.
  - 4. Vertical surfaces of casework where indicated on Drawings.

**1.2 RELATED WORK**

- A. Architectural woodwork including plywood back up for solid surfacing countertops: Section 06 40 00, ARCHITECTURAL WOODWORK.
- B. Finish, color and texture of solid surfacing: Section 09 06 00, SCHEDULE OF FINISHES.
- C. Mechanical fixtures, drains and fittings for elements located in solid polymer fabrications including rough-in and connection to such fixtures: DIVISION 22, PLUMBING.

**1.3 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Fabricator shall be equipped for and experienced in doing work including fabricating, finishing, and installing equal to standards specified, and shall be able to provide evidence of such experience to the Contracting Officer's Technical Representative's satisfaction.
- B. Allowable Tolerances:
  - 1. Variation in component size: Plus or minus 3 mm (1/8 inch).
  - 2. Location of Openings: Plus or minus 3 mm (1/8 inch) from indicated location.

**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. Solid surfacing.
- C. Samples:
  - 1. Solid surfacing color palette, 150 by 150 mm (6 by 6 inches), for each stone type, color and pattern selection.
  - 2. 200 by 250 mm (8 by 10 inch) samples of solid surfacing top with built-up double rounded edge as detailed for approval.
  - 3. Other Samples only as requested.
- D. Shop Drawings:
  - 1. Show fabrication, installation, and anchorage details.
  - 2. Show all details full size.



- E. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver solid surfacing items to job site only after proper facilities are available for handling, storing, and protecting items; receiving areas are broom cleaned; exterior openings are closed up; wet work and mechanical and electrical rough-ins are completed.
- B. Provide temporary protective covers for items during delivery, installation, and until final acceptance of Project.

#### **1.6 PROJECT CONDITIONS**

- A. Environmental Requirements:
  - 1. Finishing: Apply finishes under adequate lighting conditions and maintain temperature near 22.2 C (70 degrees F.) during application.
- B. Sequencing: Provide information as required for proper placement of backing and installation into architectural woodwork.
- C. Protection: Protect installation from damage until the Government's final acceptance.

#### **1.7 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:
  - 1. ANSI Z124.3 - Plastic Lavatories
  - 2. ANSI Z124.6 - Plastic Sinks.
- C. South Coast Air Quality Management District:
  - 1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS/PRODUCTS**

- A. Basis-of-Design Products: The design of architectural woodwork is based on products specified in this Article. Subject to compliance with requirements, provide named product or a comparable product.

#### **2.2 SOLID SURFACING**

- A. Solid Polymer Surfacing (SF).
  - 1. Description:
    - a. Solid, cast, non-porous surfacing material homogeneously, composed of natural minerals and high-performance acrylic, not coated, laminated or of composite construction with through body colors, and meeting requirements of ANSI Z124.3 or ANSI Z124.6.
    - b. Superficial damage to a depth of 0.010 inch shall be repairable by sanding and/or polishing,
    - c. Thickness: 1/2 inch unless otherwise indicated on Drawings.
    - d. Profile: As indicated on Drawings.

2. Product: E.I. du Pont de Nemours and Co., Inc.'s "Corian"; or architect approved equal.
3. Integral Sinks:
  - a. Description:
    - 1) Oval sink fabricated integral with solid surfacing countertop.
    - 2) Size: Small oval 14-3/4 by 10-1/1 inches.
  - b. Product: E.I. du Pont de Nemours and Co., Inc.'s "Corian 820 Sink"; or architect approved equal.

## **2.3 RELATED ACCESSORIES**

- A. Seam Adhesive:
  1. Two-part adhesive kit color-matched to create inconspicuous, non-porous joints.
  2. Meet or exceed VOC limits for adhesives and sealants. Adhesives must meet or exceed the VOC limits of SCAQMD #1168 by, and all sealants used as filler must meet or exceed Bay Area Air Quality Management District Reg. 8, Rule 51.
  3. Recommended by solid surfacing manufacturer.
- B. Sealant: Manufacturer's standard silicone sealant.

## **2.4 FABRICATION**

- A. Preparation:
  1. Verify dimensions of receiving spaces at job site.
  2. Verify details and dimensions of equipment and fixtures with solid surfacing fabrications for proper fit and accurate alignment.
  3. Coordinate details with other work supporting, adjoining, or fastening to solid surfacing fabrications.
  4. Coordinated location and size of cutouts and holes in solid surfacing fabrications for plumbing fixtures with plumbing rough-in prior to fabrication.
- B. General:
  1. Factory fabricate solid surfacing sheets and components to greatest extent practicable to sizes and shapes indicated, in accordance with approved shop drawings. Sheet thickness shall be 19 mm (3/4 inch) unless otherwise noted.
  2. Provide built-up double rounded edge treatment as shown on drawings.
  3. Form seams between components using manufacturer's standard seam adhesive; without conspicuous seams.
  4. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
  5. Cut and finish component edges with clean, sharp returns. Route radii and contours to template. Repair or reject defective and inaccurate work.
  6. Coved Backsplashes: Field fabricate 13 mm (1/2 inch) radius cove at intersection of counters and backsplashes. Form backsplashes using 13 mm (1/2 inch) solid polymer.
  7. Provide cut-outs as required and indicated on Drawings.
  8. Provide for concealed anchorage of tops and splashes.

## **2.5 SOURCE QUALITY CONTROL**

- A. Inspection: Maintain phases of shop fabrication open to inspection by the Contracting Officer's Technical Representative.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas scheduled to receive solid surfacing fabrications for conditions that will adversely affect installation.
- B. Do not install items before unsatisfactory conditions have been corrected.
- C. Obtain the Contracting Officer's Technical Representative's approval before installation.

### **3.2 INSTALLATION**

- A. Install solid surfacing components plumb and level, scribed to adjacent finishes, in accordance with approved shop drawings and product installation data.
- B. Coordinate solid surfacing fabricated items with architectural woodwork for placement and installation of solid surfacing fabricated items.
- C. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- D. Provide backsplashes and side splashes as indicated on the drawings. Adhere to countertops using manufacturer's standard color-matched silicone sealant or adhesive as recommended by manufacturer.
- E. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Keep clean until Date of Substantial Completion. Replace stained components.
- F. Protect surfaces from damage until Date of Substantial Completion. Repair work or replace damaged work that cannot be repaired to the Contracting Officer's Technical Representative's satisfaction.

### **3.3 CLEANING AND ADJUSTING**

- A. Remove damaged, soiled, or otherwise disfigured portions and replace with new prior to final acceptance.
- B. Wash finished work in strict accordance with product manufacturer's directions and ensure that washed surfaces do not differ from clean unwashed portions. Any difference will be considered unsatisfactory work.

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**SECTION 07 84 00**  
**FIRESTOPPING**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Closures of openings in walls and floors 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 five 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. ASTM International (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 100 mm (4 in) nominal pipe or 0.01 m<sup>2</sup> (16 sq. in.) 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 to 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 ASTM 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 150 mm (six 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    CLEAN-UP 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 Contracting Officer's Technical Representative.
- 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. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- B. Mechanical Work: COMMON WORK RESULTS FOR PLUMBING

**1.3 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.

**1.4 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. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
  - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
  - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
  - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.



**1.5 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. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. 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.

**1.6 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 4.4 °C (40 °F).
    - b. When joint substrates are wet.
- B. Joint-Width Conditions:
  - 1. 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:
  - 1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

**1.7 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 32° C (90° F) or less than 5° C (40° F).

**1.8 WARRANTY:**

- A. Warranty exterior 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 two 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 International (ASTM):
  - C612-10.....Mineral Fiber Block and Board Thermal Insulation
  - 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
- C. Sealant, Waterproofing and Restoration Institute (SWRI).
  - The Professionals' Guide

**PART 2 - PRODUCTS**

**2.1 SEALANTS:**

- A. 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 32° C (minus 26° 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-NON POROUS SURFACES:**

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing materials, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous 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 3 mm (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 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (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 5° C and 38° C (40° and 100° F).
  - 2. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
  - 3. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
  - 4. Avoid dropping or smearing compound on adjacent surfaces.
  - 5. Fill joints solidly with compound and finish compound smooth.
  - 6. Tool joints to concave surface unless shown or specified otherwise.
  - 7. Finish floor joints flush unless joint is otherwise detailed.
  - 8. Apply compounds with nozzle size to fit joint width.
  - 9. 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 6 mm (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 6 mm (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.

### **3.6 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.

### **3.7 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. Interior Caulking:
  - 1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1.
  - 2. Exposed Isolation Joints at Top of Full Height Walls: Type C-1 or S-9.
  - 3. Exposed Acoustical Joint at Sound Rated Partitions Type S-9.
  - 4. Concealed Acoustic Sealant Type C-2.

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**SECTION 08 11 13  
HOLLOW METAL FRAMES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel frames, related components, and installation of their hardware.
- B. Terms relating to steel frames as defined in ANSI A123.1 and as specified.

**1.2 RELATED WORK**

- A. Aluminum frames entrance work: Section 08 41 13, ALUMINUM STOREFRONTS.
- B. Installation of door hardware: Section 08 13 16, ALUMINUM DOORS and Section 08 14 00, INTERIOR WOOD DOORS.
- C. Door hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.

**1.3 TESTING**

- A. An independent testing laboratory shall perform testing.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show each opening indicating opening criteria, frame types, hardware locations, and details including anchors and attachment to adjacent structure, dimensions, machining criteria for hardware.

**1.5 SHIPMENT**

- A. Prior to shipment label each 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 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):

A250.8-03.....Standard Steel Doors and Frames

D. ASTM International (ASTM):

A1008-08.....Steel, sheet, Cold-Rolled, Carbon, Structural,  
High Strength Low Alloy and High Strength Low  
Alloy with Improved Formability

E. The National Association Architectural Metal Manufacturers (NAAMM):

AMP 500 Series.....Metal Finishes Manual

**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 METAL FRAMES**

- A. General:
  - 1. SDI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
  - 2. Rout doors for hardware using templates and location heights specified in Section 08 71 00, DOOR HARDWARE.
  - 3. Knocked-down frames are not acceptable.
- B. Reinforcement and Covers:
  - 1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
  - 2. Provide mortar guards securely fastened to back of hardware reinforcements except on lead-lined frames.
- C. Terminated Stops: SDI A250.8.
- D. Two piece frames:
  - a. One piece unequal leg finished rough buck sub-frames as shown, drilled for anchor bolts.
  - b. Unequal leg finished frames formed to fit subframes and secured to subframe legs with countersunk, flat head screws, spaced 300 mm (12 inches) on center at head and jambs on each side.
  - c. Preassemble at factory for alignment.



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 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts. Use 50 mm x 50 mm (2 inch by 2 inch) 9 mm by (3/8 inch) clip angle for lead lined frames, drilled for 9 mm (3/8 inch) floor bolts.
- c. Where mullions occur, provide 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two 6 mm (1/4 inch) floor bolts and frame anchor screws.
- d. Where sill sections occur, provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for 6 mm (1/4 inch) floor bolts and frame anchor screws. Space floor bolts at 50 mm (24 inches) on center.

2. Jamb anchors:

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.
- b. Form jamb anchors of not less than 1 mm (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. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

F. Provisions for Hardware and Security Devices:

1. Prepare frames for hardware in accordance with DHI A115 Series, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
2. Factory machine frames for finish hardware and security devices in accordance with templates location heights specified in Section 08 71 00, DOOR HARDWARE.
3. Provide reinforcing and cutouts as required to receive hardware and security devices.
4. Factory machine as required for sensors, contacts, and similar devices as indicated on the Drawings.
5. Mortise Hardware and Security Devices: Provide cutouts with drilled and tapped minimum 10 gauge steel reinforcement.
6. Other Hardware: Make total thickness of areas requiring reinforcement equal to nominal thickness of fastener required by hardware item.

**2.3 SHOP PAINTING**

- A. SDI 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 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
2. Power actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:

1. Anchors in masonry walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
3. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
4. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where subframes or rough bucks are used, 6 mm (1/4 inch) expansion bolts on 600 mm (24 inch) centers or power activated drive pins 600 mm (24 inches) on centers. Secure two piece frames to subframe or rough buck with machine screws on both faces.

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

### 3.2 CLEANING

- A. After installation, clean surfaces, remove temporary labels, paint spots and other defacement.
- B. Clean prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the manufacturer.

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**SECTION 08 14 00  
INTERIOR WOOD DOORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies interior flush wood doors with factory applied transparent finish and installation of their hardware.

**1.2 RELATED WORK**

- A. Steel door frames: Section 08 11 13, HOLLOW METAL FRAMES.
- B. Door hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.
- C. 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. Samples:
  - 1. Corner section of flush veneered door 300 mm (12 inches) square, showing details of construction, labeled to show grade and type number and conformance to specified standard.
  - 2. Veneer sample 200 mm (8 inch) by 275 mm (11 inch) by 6 mm (1/4 inch) showing specified wood species sanded to receive a transparent finish. Apply factory finish over one half of veneer sample.
- 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 and pertinent details.
  - 3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.

**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.

**1.5 DELIVERY AND STORAGE**

- A. Factory seal doors and accessories in minimum of 6 mill polyethylene bags or cardboard packages which shall remain unbroken during delivery and storage.
- B. Store in accordance with WDMA I.S.1-A, J-1 Job Site 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.1-A-04.....Architectural Wood Flush Doors
- C. Door and Hardware Institute (DHI):
  - A115 Series.....Steel Door and Frame Preparation for Hardware,  
Series A115.1 through A115.17 (Dates Vary)

## PART 2 - PRODUCTS

### 2.1 FLUSH DOORS

- A. General:
  - 1. Meet requirements of WDMA I.S.1-A, Extra Heavy Duty.
  - 2. Solid Core types S-5 or S-9 and for fire rated door Type S-13.
  - 3. Adhesive: Type II
  - 4. Thickness: 45 mm (1-3/4 inches) unless otherwise shown or specified.
- B. Face Veneer:
  - 1. In accordance with WDMA I.S.1-A.
  - 2. One species throughout the project unless scheduled or otherwise shown.
  - 3. For transparent finishes: Premium Grade to match adjacent existing doors.
    - a. AA grade face veneer
    - b. Match face veneers for doors for uniform effect of color and grain at joints.
    - c. Door edges shall be same species as door face veneer.
  - 4. Factory sand doors for finishing.
- C. Wood for stops of flush doors required to have transparent finish:
  - 1. Solid Wood of same species as face veneer, except maple may be used on birch doors.
  - 2. Glazing:
    - a. 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 125 mm (5 inches) on centers.

### 2.2 FACTORY MACHINING

- A. Prepare doors for hardware in accordance with DHI A115 Series, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
- B. Factory machine doors for finish hardware and security devices in accordance with templates location heights specified in Section 08 71 00, DOOR HARDWARE.

- C. Factory fitting to conform to specification for shop and field fitting, including factory application of sealer to edge and routings.
- D. Unless otherwise detailed, fit hinged doors with 3 mm (1/8 inch) clearance at hinge stiles, 3 mm (1/8 inch) at top and lock or meeting stiles, and 19 mm (3/4 inch) between bottom rail and floor.
- E. Bevel lock edge and meeting stile of single acting wood doors 3 mm (1/8 inch) for each 50 mm (2 inches) of door thickness.
- F. Fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (two inches) of door thickness, undercut where shown.
- G. Factory fit doors for frame opening dimensions identified on Shop Drawings.
- H. Do not violate the qualified testing and inspection agency label requirements for fire rated doors.

## **2.3 FINISHES**

- A. Wood Door Faces and Edges: Factory finish doors schedule for transparent finish as follows:
  - 1. WDMA I.S.1-A Section F-3 specification for System TR-4, Conversion Varnish or System TR-5, Catalyzed Vinyl.
  - 2. Use stain when required to produce the finish specified in Section 09 06 00, SCHEDULE FOR FINISHES.

## **2.4 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 veneer and quality certification.
  - 4. Identification of preservative treatment for stile and rail doors.

## **2.5 SEALING:**

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

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install wood doors in accordance with the final shop drawings and manufacturer's data, except where more stringent requirements are specified herein.

- B. Hang wood doors and install hardware when concrete work, plastering, tile setting, and other operations have been completed which increase humidity and dust in building.
- C. Do not hang wood doors in areas where materials are not sufficiently dry so as to not affect the dimensional stability of the door.
- D. Install wood doors at correct openings; assure smooth swing and proper closure with frame.
- E. Center wood doors in the opening or frame with contact surfaces fit tight and even without forcing or warping the components.
- F. Install wood doors plumb and square.
- G. Hang wood doors to obtain free swinging operation without binding, sticking, or sagging. Maintain proper clearances between door and frame.
- H. Hardware: Install in accordance with "Standards for Installation" Article of Section 08 71 00, DOOR HARDWARE.
- I. Factory-Finished Wood Doors: Do not field cut or trim; if fit or clearance is not correct, replace door
- J. Replace wood doors and steel frames that do not conform to hardware height requirements.

### **3.2 CLEANING AND ADJUSTING**

- A. Adjust wood doors for smooth and balanced door movement and correct swinging, closing, and latching. Lubricate or wax hardware and moving parts as required.
- B. After installation, clean surfaces, remove temporary labels, paint spots and other defacement.
- C. Clean prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the manufacturer.

### **3.3 DOOR PROTECTION**

- A. As wood 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 wood door.
- C. Maintain covering in good condition until removal is approved by Contracting Officer's Technical Representative.

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**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. Installation of door hardware in accordance with standards of this Section: Section 08 11 13, HOLLOW METAL FRAMES and Section 08 14 00, INTERIOR WOOD DOORS.
- C. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Painting: Section 09 91 00, PAINTING.
- 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 UFAS, (Uniform Federal Accessible Standards) 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 Exit Doors: Conform to requirements of 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. Surface applied overhead door closers.
  - 3. Exit devices.

**1.4 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 four years of submittal of reports for approval.

**1.5 DELIVERY AND MARKING**

- A. Deliver items of hardware to job site 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 Technical Representative for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in Contracting Officer's Technical Representative's office until all other similar items have been installed in project, at which time the Contracting Officer's Technical Representative will deliver items on file to Contractor for installation in predetermined locations on the project.

**1.6 INSTRUCTIONS**

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, 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.

- A. Manufacturers' Catalog Number References: Where manufacturers' products are specified herein, products of other manufacturers which are considered equivalent to those specified may be used. Manufacturers whose products are specified are identified by abbreviations as follows:

Adams-Rite	Adams Rite Mfg. Co.	Glendale, CA
Architectural Builders Hardware	Architectural Builders Hardware Mfg., Inc.	Elk Grove Village, IL
Glynn Johnson	Glynn Johnson Co.	Chicago, IL
Ives	Ingersoll-Rand Co.	Indianapolis, IN
LCN	LCN Closers	Princeton, IL
Hager	Hager Hinge Company	Saint Louis, MO
Pemko	Pemko Manufacturing Co.	Ventura, CA
Schlage	Ingersoll-Rand Co.	Carmel, IN
Stanley	The Stanley Works	New Britain, CT
Trimco	Triangle Brass Mfg. Co.	Los Angeles, CA
Unican	Simplex Security Systems	Collinsville, CT
Von Duprin	Von Duprin Hardware Co.	Indianapolis, IN

- B. Keying: All cylinders shall be keyed into existing Key System as directed by Contracting Officer's Technical Representative. 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.
1. Keying information shall be furnished at a later date by the Contracting Officer's Technical Representative.
  2. Permanent Keys: Arrange shipment by secure carrier of permanent keys in individual packets directly from lock manufacturer to Government. Identify each packet with location and lock its keys operate, in accordance with Opening Schedule.

#### 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. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.
- B. ASTM International (ASTM):

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

A156.3-08.....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

A156.13-05.....Mortise Locks and Latches Series 1000

A156.16-08.....Auxiliary Hardware

A156.18-06.....Materials and Finishes

A156.21-09.....Thresholds

A156.22-05.....Door Gasketing and Edge Seal Systems

A156.23-04.....Electromagnetic Locks

A156.25-07 .....Electrified Locking Devices

A156.28-07 .....Master Keying Systems

A156.31-07 .....Electric Strikes and Frame Mounted Actuators

A250.8-03.....Standard Steel Doors and Frames

D. Door and Hardware Institute (DHI):

A115.1G-94.....Installation Guide for Doors and Hardware

E. National Fire Protection Association (NFPA):

80-10.....Fire Doors and Fire Windows

101-09.....Life Safety Code

F. Underwriters Laboratories, Inc. (UL):

Building Materials Directory (2008)

**PART 2 - PRODUCTS**

**2.1 BUTT HINGES**

A. ANSI A156.1.

- B. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges.
- C. Provide quantity of hinges per door leaf as follows:
  - 1. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
  - 2. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.
- D. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.
- E. 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 Contracting Officer's Technical Representative. 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.

## **2.2 DOOR CLOSING DEVICES**

- A. Closing devices shall be products of one manufacturer for each type specified.

## **2.3 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. Closers shall have full size cover.
  - 7. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
  - 8. Provide parallel arm closers with heavy duty rigid arm.
  - 9. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.

## **2.4 DOOR STOPS**

- A. Conform to ANSI A156.16.

## **2.5 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.

## **2.6 LOCKS AND LATCHES**

- A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than seven 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 19 mm (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.
- B. 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 series 1000, minimum Grade 2. All locksets and latchsets, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles similar to Falcon S-lever Design. Lever handle shall be fabricated from wrought stainless steel. No substitute lever design or material shall be accepted. All locks and latchsets shall be furnished with curved lip strike and wrought box. Lock function F02 shall be furnished with key plates similar to Corbin-Russwin No. 43F90. All lock cases installed on lead lined doors shall be lead lined before applying final hardware finish. Furnish armored fronts for all mortise locks.
  - 2. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.5.

## **2.7 ELECTRIC STRIKES**

- A. ANSI/ BHMA A156.31 Grade 1.
- B. General: Use fail-secure electric strikes with fire-rated devices.
- C. Manufacturers:
  - 1. Adams Rite Manufacturing Co.
  - 2. Folger Adam Security Inc.; an ASSA ABLOY Group company.
  - 3. HES, Inc.; an ASSA ABLOY Group company.
  - 4. Locknetics; an Ingersoll-Rand Company.
  - 5. Precision Hardware, Inc.
  - 6. Von Duprin; an Ingersoll-Rand Company.
  - 7. or architect approved equal.

**2.8 KEYS**

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

<b>Locks/Keys</b>	<b>Quantity</b>
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

**2.9 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-mop plates and armor plates plastic or metal, Type J100 series, color as required. When wood grain plastic plates are indicated in Finish Legend on Drawings, wood grain of plates shall run perpendicular to direction of grain of face veneer of wood doors.
  2. Provide kick-mop plates for both sides of each new door, except AS noted in Door Schedule. Kick-mop plates shall be 200 mm (8 inches) high. On push side of doors where jamb stop extends to floor, make combination kick-mop plates 38 mm (1-1/2 inches) less than width of door, except pairs of doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other combination kick-mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.
  3. Armor plates for doors are listed in Door Schedule. Armor plates shall be 875 mm (35 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors. Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt cross bar.
  4. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick-mop plate in place of armor plate. Size of stretcher plate and kick-mop plate shall be 200 mm (8 inches) high.
  5. Kick plates and armor plates over 450 mm (18 inches) high on fire rated doors must be labeled as required by fire rating.

**2.10 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. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

#### **2.11 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. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.
- C. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) from frame face.

#### **2.12 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).

#### **2.13 WEATHERSTRIPS (FOR EXTERIOR DOORS)**

- A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length ( $0.000774\text{m}^3/\text{s/m}$ ).
- B. At exterior doors that do not have a trellis or roof cover are to have drip door head by Pemko.

#### **2.14 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. 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.

**2.15 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 Contracting Officer. 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.

**2.16 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 --interior doors: 652.
  - 2. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
  - 3. Thresholds: Mill finish aluminum.
  - 4. Cover plates for floor hinges and pivots: 630.
  - 5. Other primed steel hardware: 6652.
- D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces.
- E. 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<sup>+</sup>). Silver ions surround bacterial cells, inhibiting growth of bacteria, mold, and mildew by blockading food and respiration supplies.

**2.17 BASE METALS**

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

<b>Finish</b>	<b>Base Metal</b>
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 Contracting Officer's Technical Representative for approval.
- B. Hardware Heights from Finished Floor:
  - 1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
  - 2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
  - 3. Centerline of door pulls to be 1016 mm (40 inches).
  - 4. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
  - 5. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
  - 6. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

### **3.2 REMOVAL OF EXISTING HARDWARE, MODIFICATIONS OF EXISTING FRAMES/DOORS**

- A. Remove existing hardware on doors to be removed and provide to VA as directed by Contracting Officer's Technical Representative.
- B. Modify existing doors, frames, thresholds, door undercuts and all other components of doors and surrounding material as necessary to meet the functional requirements indicated in Hardware Groups for doors indicated.
- C. Repair and re-certify existing door frames that are required to be modified as a result in changes to door hardware, door swing, strike plate, power transfers and butt hinge modifications.
- D. All existing hardware components that are no longer required as a result of changed hardware indicated in hardware groups shall be removed and frames/doors/surrounding materials restored to original new condition as required.

### **3.3 STANDARDS FOR INSTALLATION OF HARDWARE**

- A. Install door hardware in accordance with manufacturer's templates and instructions and DHI A115.1G unless specified otherwise.
- B. Install hardware for fire-rated openings in accordance with NFPA and requirements for door manufacturer's fire rating listing.
- C. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- D. Use shims only at hinges where required to provide uniform clearance and alignment of door. Cut shims from stainless steel sheet to same size as hinge.
- E. Do not drive screws in place.



- F. Do not install surface-mounted hardware until finishes have been completed on substrates involved.
- G. Fitting: Accurately and properly fit door hardware. Securely fasten fixed parts for smooth, trouble-free, nonbinding operation; fit faces of mortised parts snug and flush; operating parts shall move freely and smoothly without binding, sticking or excessive clearance.
- H. Ensure door hardware displays no evidence of finish paint after final building clean up with exception of prime-coated door hardware installed for finish painting. Contractor may achieve this by sequencing installation, removing after fitting and reinstalling after painting is completed, providing protection, cleaning to original hardware finish or other approved means.
- I. Latch and Bolt:
  - 1. Install latch and bolt to automatically engage in keeper, whether activated by closer or by manual push; in no case shall additional manual pressure be required to engage latch or bolt in keeper.
  - 2. After locks have been installed; show in presence of Contracting Officer's Technical Representative that keys operate their respective locks in accordance with keying requirements.
  - 3. 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 Contracting Officer's Technical Representative for his records.
  - 4. 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.
- J. Closers:
  - 1. Where closers are mounted on doors, mount with hex nuts and bolts; fasten foot to frame with machine.
  - 2. Mount to provide maximum door opening permitted by building construction or equipment.
  - 3. Adjust closer delay and operating speeds to comply with requirements of Americans with Disabilities Act Architectural Guidelines, Article 4.13.10.
  - 4. Adjust sweep period of door closers so that from an open position of 70 degrees, door will take at least 3 seconds to move to a point 3 inches from that latch, measured to leading edge of door.
  - 5. Do not mount closers on corridor or vestibule side of door, except at exterior doors.
  - 6. Supply drop plates at narrow top rail doors.
  - 7. Carefully adjust closers to operate noiselessly and evenly.
  - 8. Where closers are mounted on doors they shall be mounted with sex nuts and bolts; foot shall be fastened to frame with machine screws.
  - 9. Substitute parallel arm or top jamb mounting for regular arm mounting where the following conditions occur:
    - a. Where door swing, in full open position, would be limited to less than 90 degrees due to partition construction and closer location.
    - b. Where door to room opens outward into corridor, except security bedroom, bathroom and anteroom doors which shall have closer installed parallel arm on exterior side of doors.
    - c. Where exterior doors open outward.

K. Thresholds:

1. Install thresholds in a bed of sealant with machine screws and expansion shields. For sealant see Section 07 92 00, JOINT SEALANTS.
2. Cut thresholds to closely fit jambs.
3. Drill and cut for door holders and bottom bolts where required.

L. Installing Weatherstripping And Seals

1. Accurately cut and fit weatherstrips and seals. Carefully aligned for full contact and tight seal and secure firmly to maintain weatherproof, waterproof, and lightproof seal without preventing smooth and easy operation of doors.
2. Provide suitable blocking where necessary to clear hardware; and make adjustments as required to meet special conditions encountered.
3. Prime paint wood surfaces which have been cut with wood sealer before weatherstrips are installed.

M. Install automatic door bottom so that gasket is automatically forced down to tightly seal instantly when the door is fully closed, and raised instantly when the door begins to open. Mount automatic door bottom to provide 5 mm (3/16 inch) clearance at door bottom.

N. 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.

### 3.4 FINAL INSPECTION

- A. Installer to provide letter to VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:
1. Re-adjust 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.

### 3.5 DEMONSTRATION

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

### 3.6 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.

**Office/ Shared Office/Exam: Rooms 100, 101, 102D, 105, 109, 131, 140, 140A**

<b>HW-02</b>	<b>Each Opening To Receive:</b>				
As Req'd	Butt Hinges 4-1/2 x 4-1/2, Hospital Tip, Full Mortise, 5-Knuckle, NRP	ANSI A8112	HT-BB1279-NRP	652	HAG
1 EA	Mortise Lockset, Office Function, Lever Handle Trim	ANSI F04	L9050	630	SCH
1 EA	Cylinder Best 7-pin, Interchangeable Core (no substitutions)	ANSI A156.5	1E Series	630	BEST
1 SET	Gasketing		S88	TAN	PEM
1 EA	Floor Stop			626	
1 EA	Automatic Door Bottom		420ASL		PEM

**Entry & Equipment Rooms (Able to be left Locked or Unlocked): Rooms 128, 130, 132, 134, 135, 138, 139, 150**

<b>HW-008</b>	<b>Each Opening To Receive:</b>				
As Req'd	Butt Hinges 4-1/2 x 4-1/2, Hospital Tip, Full Mortise, 5-Knuckle, NRP	ANSI A2111	HT-BB1199-NRP	626	HAG
1 EA	Mortise Lockset, Classroom Function, Lever Handle Trim	ANSI F05	L9070	630	SCH
1 EA	Cylinder Best 7-pin, Interchangeable Core (no substitutions)	ANSI A156.5	1E Series	630	BEST
1 EA	Closer w/ Spring Cush Arm	ANSI A156.5, GR 1	4040 Series	AL	LCN
1 SET	Gasketing		S88	TAN	PEM
1 EA	Floor Stop				

**Medication Room/Staff Areas with Card Reader: Room 102C**

<b>HW-003</b>	<b>Each Opening To Receive:</b>				
As Req'd	Butt Hinges 4-1/2 x 4-1/2, Hospital Tip, Full Mortise, 5-Knuckle, NRP	ANSI A8111	HT-BB1168-NRP	652	HAG
1 EA	Electrified Mortise Lockset, Storeroom Function, Lever Handle Trim (Fail Secure)	ANSI F07 sim	L9080EU	630	SCH
1 EA	Cylinder Best 7-pin, Interchangeable Core (no substitutions)	ANSI A156.5	1E Series	630	BEST
1 EA	Closer	ANSI A156.5, GR 1	4040 Series	AL	LCN
1 SET	Gasketing		S88	TAN	PEM
1 EA	Floor Stop			626	
1 EA	Power Transfer		EPT-10		VON
1 EA	Power Supply		As Required		
1 EA	Card Reader (in J-box per Electrical)		By Government		

- - - E N D - - -

**SECTION 08 80 00  
GLAZING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies:
  - 1. Glass and related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.
  - 2. Resin panels installed in aluminum framing.

**1.2 RELATED WORK**

- A. Resin panels incorporated in architectural woodwork: Section 06 40 00, ARCHITECTURAL WOODWORK.
- B. 08 14 00 Interior WOOD DOORS
- C. Color, finish and texture of resin panels: Section 09 06 00, SCHEDULE OF FINISHES.

**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 Technical Representative.
- 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:
  - 1. Thicknesses listed are minimum. 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. Glazing cushion.
3. Sealing compound.
4. Resin panels and aluminum framing

D. Samples:

1. Glass Types: 150 mm by 150 mm (6 inches by 6 inches) of each glass type and resin panel color.
2. Resin Material Panels: Four samples of each color, 150 mm by 150 mm (6 by 6 inch), for color and pattern verification.

**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.

**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 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):  
  
Z97.1-04.....Safety Glazing Material Used in Building -  
Safety Performance Specifications and Methods  
of Test
- C. ASTM International (ASTM):  
  
A167-99 ..... Standard Specification for Stainless and Heat-  
Resisting Chromium-Nickel Steel Plate, Sheet,  
and Strip  
  
C864-05.....Dense Elastomeric Compression Seal Gaskets,  
Setting Blocks, and Spacers  
  
C920-08.....Elastomeric Joint Sealants  
  
C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated  
and Uncoated Glass

- C1172-09.....Laminated Architectural Flat Glass.
- E84-09.....Surface Burning Characteristics of Building  
Materials
- E119-05a.....Fire Tests of Building Construction and  
Materials
- E1300-09.....Determining Load Resistance of Glass in  
Buildings
- E2190-08.....Insulating Glass Unit
- D. National Fire Protection Association (NFPA):
- 80-10.....Fire Doors and Windows
- E. National Fenestration Rating Council (NFRC)
- Certified Products Directory (Latest Edition).
- F. Safety Glazing Certification Council (SGCC)2009:
- Certified Products Directory (Issued Semi-Annually).
- G. Glass Association of North America (GANA):
- 01.....Glazing Manual (1997 Edition).
- 02.....Sealant Manual (1990 Edition)
- 04.....Tempered Glass Engineering Standard Manual  
(2001 Edition)

## **PART 2 - PRODUCT**

### **2.1 GENERAL**

- A. Basis-Of-Design Products: The design of glass types and resin material panel is based on products specified in this article. Subject to compliance with requirements, provide named product or a comparable product.

### **2.2 GLASS TYPES**

- A. Glass Type GL-1, Patterned Glass:
1. Description:
    - a. Etched glass, Ultraclear low iron glass fully tempered, Type II, Form #, Quality-Q-5, Finish F 2 (etched both sides).
    - b. Thickness: 6 mm (1/4 inch).
    - c. Edges: Polished.
  2. Manufacturer: Skyline Design's "Sateen, Option C pattern on both sides"; or architect approved equal.
- B. Glass Type GL-2, Clear Fully Tempered Glass:

1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
2. Thickness: 6 mm (1/4 inch), unless otherwise indicated.

### **2.3 RESIN MATERIAL PANELS (RS)**

- A. Panel Material:
1. Product: Same as specified in Section 06 40 00, ARCHITECTURAL WOODWORK.
  2. Colors: Refer to Section 09 06 00, SCHEDULE OF FINISHES.
- B. Aluminum Framing:
1. Product: 3Form, Inc.'s "3Form Frame"; or architect approved equal
  2. Finish: Refer to Drawings.

### **2.4 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. Aluminum Channel: Shape and size as indicated on Drawings, clear anodized finish.
- C. Setting Blocks: ASTM C864:
1. Channel shape; having 6 mm (1/4 inch) internal depth.
  2. Shore a hardness of 80 to 90 Durometer.
  3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.
  4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
  5. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.
- D. Spacers: ASTM C864:
1. Channel shape having a 6 mm (1/4 inch) internal depth.
  2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
  3. Lengths: One to 25 to 76 mm (one to three inches).
  4. Shore a hardness of 40 to 50 Durometer.
- E. 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.
- 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, 6 mm (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. 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.
- J. 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.
- K. 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 with 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:
  1. 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. Glaze doors in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. GL-1, Patterned Glass:
  - 1. Install units with one patterned surface with smooth surface on the weather side.
  - 2. Install units in interior partitions with pattern in same direction in all openings.
- G. GL-2, Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.

### **3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING)**

- A. Cut glazing tape or spline to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/3 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Trim protruding tape edge.

### **3.5 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)**

- A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

- C. Place setting blocks at 1/3 points with edge block no more than 150 mm (6 inches) from corners.
- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.
- F. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line.
- G. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

### **3.6 INSTALLATION - WET METHOD (SEALANT AND SEALANT)**

- A. Place setting blocks at 1/3 points and install glazing pane or unit.
- B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- C. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 9 mm (3/8 inch) below sight line to ensure full contact with glazing and continue the air and vapor seal.
- D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

### **3.7 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)**

- A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.
- B. Place setting blocks at 1/3 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- E. Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.
- F. Trim protruding tape edge.

### **3.8 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)**

- A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 600 mm (24 inch) centers, kept 6 mm (1/4 inch) below sight line.
- B. Locate and secure glazing pane using glazers' clips.
- C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

### **3.9 INSTALLATION OF RESIN PANELS**

- A. Install resin panels in aluminum framing as recommended by resin panel manufacturer.

### **3.10 REPLACEMENT AND CLEANING**

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by Contracting Officer's Technical Representative.
- 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.

### **3.11 PROTECTION**

- A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

### **3.12 GLAZING SCHEDULE**

- A. Refer to Drawings for locations glass types.

- - - E N D - - -

**SECTION 09 06 00  
INTERIOR FINISHES, MATERIALS,  
AND FINISH SCHEDULE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section contains a coordinated color system in which requirements for materials specified in other sections of this specification and/or shown on the drawings are identified by color codes and/or paint finishes.
- B. This section is intended for the purpose of identifying finishes and colors only. Refer to individual technical specification sections for material and product properties and requirements and for installation requirements.

**1.2 MANUFACTURERS**

- A. Manufacturer's (mfr.) trade names and numbers used herein identify colors, finishes, textures, and patterns. Subject to the approval of the contracting officer, products of other manufacturers will be considered, provided they are equivalent to the colors, finishes, textures and patterns of the manufacturers listed, and meet the requirements of the technical specifications and drawings.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Furnish quadruplicate samples for color approval of all materials, colors, and textures specified in this section.

**1.4 INDEX AND SPECIFICATION REFERENCE**

	<u>Specification Section</u>
<b>PAINT</b>	
2.1. A. Painting	09 91 00
<b>FLOORING</b>	
2.2.A. Resilient Sheet Flooring (RSF) with Integral Coved Base (CB)	09 65 19
2.2.B. Resilient Tile Flooring (RTF)	09 65 19
2.2.C. Porcelain Tiling (PT)	09 30 13
2.2.D. Marble Transition	09 30 13
2.2.E. Resinous Flooring (RF)	09 67 23
<b>INTERIOR WALLS</b>	
2.3.A. Aluminum Doors and Frames	08 13 16
2.3.B. Interior Wood Doors	08 14 00
2.3.C. Kick, Mop and Armor Plates	08 xx xx
2.3.D. Resilient Base (RB)	09 65 13
2.3.E. Wood Veneer(WV)	06 40 00
2.3.F. Wall Protection Panel (PP)	10 26 00
2.3.G. Ceramic Tiling (CT)	09 30 13
<b>CEILING</b>	
2.4.A. Acoustical Ceiling Tile (AP)	09 51 00
2.4.B. Linear Wood Plank Ceiling	09 54 26
<b>ARCHITECTURAL WOODWORK</b>	
2.5.A. Plastic Laminate (PL)	06 40 00
2.5.B. Solid Polymer Surfacing Material (SF)	06 61 16
2.5.C. Patterned Glass (GL)	08 80 00
2.5.D. Cabinet Pulls & Hardware	06 40 00
2.5.E. Resin Material (RS)	06 40 00
<b>MISCELLANEOUS - INTERIOR</b>	
2.6.A. Architecturally Exposed Aluminum	06 40 00
2.6.B. Miscellaneous Wood and Metal Requiring Paint	09 91 00
2.6.C. Resilient Corner Guards	10 26 00
2.6.D. Window Shades	12 24 00
2.6.E. Tackboards	10 11 23
2.6.F. Cubicle Curtains	10 21 23

**PART 2 - PRODUCTS****2.1 PAINT (P)**

## A. Painting:

1. Texture:
  - a. SG: Semi-Gloss
  - b. EGS: Eggshell

	<u>MANUFACTURER</u>	<u>COLOR NUMBER</u>
P-1:	Dunn Edwards	#SP836 Swiss Coffee (all painted surfaces)

**2.2 FLOORING**

## A. Resilient Sheet Flooring- Rubber sheet flooring with heat welded seams and integral cove base (RSF):

## 1. Flooring:

	<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
RSF-1:	Artigo	Kayar	K-27, w/ matching welding rod
RSF-2:	Artigo	Kayar	K-52, w/ matching welding rod

## 2. Integral Cove Base:

	<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
CB-1:	Artigo	Kayar	K-27
CB-2	Artigo	Kayar	K-52

## B. Resilient Tile Flooring- Rubber tile flooring(RTF):

## 1. Flooring:

	<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
RTF-1:	Artigo	Kayar	K-27
RTF-2:	Artigo	Kayar	K-52
RTF-1:	Artigo	Kayar	K-54

## C. Porcelain Tiling (PT)

- a. Manufacturer: Ann Sacks
- b. Product: Summit
- c. Color: Charcoal, Natural Rectified
- d. Size: 11-5/8" x 23-3/8"
- e. Surface bullnose trim to match, 2-7/8" x 17-3/8"
- f. Grout: Custom Building Products Epoxy Grout. Color TBD.

## D. Marble Transition

<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
Daltile	Double Bevel Threshold 4"x36"x5/8"	Carrara White, CDM701

## E. Resinous Flooring (RF)

<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
Stonehard	Stoneguard MD	Malt

**2.3 INTERIOR WALLS**

## A. Aluminum Doors and Frames

## 1. Sliding Door &amp; Side Panel:

<u>MANUFACTURER</u>	<u>PRODUCT</u>
Stanley	Series 7000 TL ICU-Manual Slide, 2 Panels, Clear Anodic Finish

## 2. Swinging Door:

<u>MANUFACTURER</u>	<u>PRODUCT</u>
RACO Interior Products Inc.	Series 550, #14 Clear Anodic Coating

## B. Wood Doors:

<u>MANUFACTURER</u>	<u>FINISH</u>
Eggers Industries	Match existing.

## C. Kick-Mop and Armor Plates:

1. All doors to receive kick plates on push side and mop plates on pull side
2. Provide Stainless steel plates.

<u>MANUFACTURER</u>	<u>Finish</u>
Forms and Surfaces	Stainless Steel Satin

## D. Resilient Base (RB):

	<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>STYLE/COLOR</u>
RB-1:	Johnsonite	Millwork Contoured Wall Base	Reveal/179 Steel

## E. Wood Veneer (WV)

1. Refer to Interior Elevations and Interior Finish Schedule for locations.
2. See Interior Elevations for veneer dimensions and aluminum reveal locations.
3. Use standard width sheets.
4. See 2.6.A for aluminum reveal moldings at wood veneer walls.

	<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>STYLE/COLOR</u>
WV-1:	RJF Int'l Corp.	Arbor Series	Maple White FC

## F. Wall Protection Panel (PP)

<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
C/S Acrovyn	Acrovyn 4000 High Impact Rigid Sheet	#253 Parchment Suede Texture

## G. Ceramic Tiling (CT)

	<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR/SIZE</u>
CT-1	Ann Sacks	Capriccio	Soft Yellow Gloss, 3"x6"
CT-2	Ann Sacks	Davenport	Summer, 6"x12"

**2.4 CEILING**

Refer to the Reflected Ceiling Plan for Acoustic Panel type and location.

**A. Acoustical Ceiling Treatment:**

1. Acoustic Ceiling Tile (AP-1):
  - a. Manufacturer: Armstrong World Industries.
  - b. Size: 24" x 24"
  - c. Product: #1952 Ultima with high CAC, Square Tegular
  - d. Provide Humiguard Plus & Bioblock Plus
  - e. Color: White.
2. Acoustic Ceiling Tile with Techzone (AP-2):
  - a. Manufacturer: Armstrong World Industries.
  - b. Size: 24" x 72"
  - c. Product: #3261 Optima with foil backing, Square Tegular
  - d. Technical Panel: #1403 Optima with foil backing, Square Tegular.
    - 1) Panel sizes: 6" x 48" and 6" x 60", refer to drawings. Cut in factory when possible.
  - e. Color: White

**B. Suspension System:**

1. AP-1
 

<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
Armstrong	Suprafine XL 9/16"	White
	Metal Square Tegular	
2. AP-2
 

<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
Armstrong	Suprafine XL 9/16"	White
	Metal Square Tegular	

**C. Linear Wood Ceiling (Grille Type)**

- a. Manufacturer: 9Wood, Inc
- b. Species: Cherry, Quarter Sliced
- c. Product: Wood Panels: 1100 Cross Piece Backer Wood Grille, SKU 1113-8
- d. Color: Clear Coat
- e. Assembly Style: Cross Piece Backer
- f. Fire rating: Class 1(A)
- g. At any access panel locations, provide removable wood panels per manufacturers details
2. Acoustic Insulation
  - a. Manufacturer: Owens Corning
  - b. Product: 1" Select sound Black acoustic Blanket

**D. Suspension System: Metal Furring Channel. Provide standard interior 20 gauge 7/8" metal furring channels.**

<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
Dietrich	FC Series	Black

**2.5 ARCHITECTURAL WOODWORK****A. Plastic Laminate (PL):**

	<u>MANUFACTURER</u>	<u>COLOR</u>
PL-1:	Formica	African Limba 7011-43
PL-2	Wilsonart	White 1570-60



## B. Solid Polymer Surfacing Material (SF):

	<u>MANUFACTURER</u>	<u>COLOR</u>
SF-1	Corian	Whisper (@ all work surfaces & sills @ patient cubicles)

## C. Patterned Glass (GL):

	<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>PATTERN</u>
GL-1	Skyline Design	Weaves + Textures	Sateen C, low iron (run stripes in horizontal direction.)

## D. Cabinet Pulls and Hardware:

- a. Finish: All exposed hardware to be Satin Nickel
- b. Hinges to be Matt Nickel plated,
- c. Shelf supports to be powder coated to match cabinet/shelf finish
- d. Grommets for Cable passage through countertop to be Hafele, Silver/aluminum RAL 9006 w/brushed finish
- e. Cabinet pulls: Provide Continuous Extruded Aluminum pulls. Pull to extend full length of cabinets and drawers.  
<http://www.paramountextrusions.com/pulls.htm>  
Style: Kerf mounted Pull, #5122  
Finish: Powder coat to match cabinet finish
- f. Do not use exposed fasteners except where indicated.
- g. For Exposed fasteners use Phillips flathead screws

## E. Resin Material (RS):

	<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
RS-1:	3-form	Chroma	Ghost
RS-2:	3-form	Chroma	White Out
RS-3:	3-form	Chroma	Flood + Ghost

**2.6 MISCELLANEOUS - INTERIOR**

## A. Architecturally Exposed Aluminum: All Channel Trims in Casework and Reveal moldings in Gyp. Board walls to have a clear anodized finish.

1. Provide Reveal Moldings , trims and Reveals as indicated on drawings and details
2. Provide Factory Fabricated : End caps, "T" intersections, "L" intersections, "X" intersection outside and inside corners where occur.

	<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR/TEXTURE</u>
Misc.: Aluminum Moldings	Fry Reglet	As indicated	Clear Anodized
Metal Base	Fry Reglet	Reveal Base DRMB-625-400	Clear Anodized

## B. Miscellaneous Wood and Metal Requiring Paint: Grilles, access panels, pipes, except specific colors required by section "painting" and conduits (ferrous and non-ferrous) heating, ventilating and air conditioning units and connections, etc. Color to match adjoining surface, SG texture

## C. Resilient Corner Guards:

1. Refer to the Floor Plans and Interior Elevations for Corner Guard locations and dimensions.
2. Corner Guards to be installed from top of base to ceiling at all locations, unless otherwise noted in the drawings.

<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR/TEXTURE</u>
Acrovyn	SFS-20N	#253 Parchment
Acrovyn	FSC-25N	#253 Parchment

## D. Window shades:

1. Provide Widths as required per window opening. See drawings for sizes
2. Supplier to field measure and verify dimensions prior to Installation.
3. Manufacturer: Mecho Systems
4. Style: EcoVeil Screens
5. 0950 Series (1% open)
6. Color: 0969 Silver Birch
7. Provide Ultra Glide operating system

## E. Tackboards

<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
Tri-kes	Glamour Wallcovering	PTGL-04 Ice

## F. Cubicle Curtains

<u>MANUFACTURER</u>	<u>PRODUCT</u>	<u>COLOR</u>
Knoll Textiles	Trace C1440/1	Opal

**PART 3 - EXECUTION****3.1 GENERAL NOTES**

- A. All wall paint finishes to be LL (low luster) unless otherwise noted.
- B. Refer to reflected ceiling plans for ceiling heights and details.
- C. Refer to Floor Finish Plan for Floor patterns and details.
- D. All Interior Finishes to comply with maximum flame spread requirements per the IBC

**3.2 INTERIOR COLOR AND FINISH SCHEDULE**

- A. Schedule is found in the drawings on sheet AS10.00.

- - - END - - -

**SECTION 09 22 16  
NON-STRUCTURAL METAL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel studs wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board or other building boards.

**1.2 RELATED WORK**

- A.

**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 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. ASTM International (ASTM)
  - A123/A123M-09.....Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
  - A641/A641M-09.....Zinc-Coated (Galvanized) Carbon Steel Wire
  - A653/A653M-09.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
  - 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
  - C636-06.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
  - C645-09.....Non-Structural Steel Framing Members
  - C754-09.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
  - C841-03(R2008).....Installation of Interior Lathing and Furring
  - C954-07.....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
  - C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - E580-09.....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, and resilient furring channels, with coating designation of G-60 minimum, per ASTM A123/A123M.

## **2.2 STEEL STUDS AND RUNNERS (TRACK)**

- A. ASTM C645, modified for thickness specified, sizes and configurations as shown.
  - 1. Use ASTM A525 steel, 0.8 mm (0.0329-inch) thick bare metal 33 mil (20 gauge).
  - 2. Steel Stud Manufacturers Association designations are used on the Drawings.
  - 3. Runners same thickness as studs.
- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.

## **2.3 FURRING CHANNELS**

- A. Rigid furring channels (hat shape): ASTM C645.
- B. Resilient furring channels:
  - 1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
  - 2. Semi-hat shape, only one 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 BACKING**

- A. Gauges, configurations, and sizes as indicated on Drawings. Material to meet requirements of ASTM A653/A653M and with G-60 galvanized coating in accordance with ASTM A123/A123M.

## **2.5 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES**

- A. ASTM C754, except as otherwise specified.
- B. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- C. 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.
- D. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- E. Tie Wire and Hanger Wire:
  - 1. ASTM A641/A641M, soft temper, Class 1 coating.
  - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.

F. Attachments for Wall Furring:

1. Manufacturers 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 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.

G. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

**2.6 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)**

- A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.
- B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

**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 studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 610 mm (24 inches) on center.
- C. Cut studs 6 mm to 9 mm (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, and sound rated partitions.
- F. Openings:
  1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
  2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
  3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (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 two 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 63 mm (2-1/2 inches wide).

I. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.

J. Form control joint, with double studs spaced 13 mm (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 63 mm (2-1/2 inch) or narrower studs, 600 mm (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 three foot vertical intervals on side without finish.
3. Securely fasten braces to each stud with two 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 600 mm (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 200 mm (8 inches).
4. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two 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 100 mm (4 inches) of corner.

D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (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, wood seats, 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.
- C. Installing Backing Plates:
  - 1. Securely weld or screw cut sections of unpunched stud, flat plates, or bent plates to at least three studs or furring supports unless otherwise noted, leaving flat surface of backing stud web to receive attachment of object to be secured.
  - 2. Verify that any predrilling of backing and attachment of spacers to prevent crushing of collateral material is done prior to application of collateral material.
  - 3. If it is determined by the Contracting Officer's Technical Representative that backing was not provided for any items as required, the Contractor shall remove the finish material and install the backing. The Contractor shall patch and refinish the surface to match adjacent areas and surfaces.

### **3.5 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 400 mm (16-inch) centers for metal lath anchorage.
  - 2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.
- B. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.
- C. Existing concrete construction exposed or concrete on steel decking:
  - 1. Use power actuated fasteners either eye pin, threaded studs or drive pins for type of hanger attachment required.
  - 2. Install fasteners at approximate mid height of concrete beams or joists. Do not install in bottom of beams or joists.
- D. Steel decking without concrete topping:
  - 1. Do not fasten to steel decking 0.76 mm (0.0299-inch) or thinner.
  - 2. Toggle bolt to decking 0.9 mm (0.0359-inch) or thicker only where anchorage to steel framing is not possible.
- E. Installing suspended ceiling system for gypsum board (ASTM C635 Option):
  - 1. Install only for ceilings to receive screw attached gypsum board.
  - 2. Install in accordance with ASTM C636.
    - a. Install main runners spaced 1200 mm (48 inches) on center.
    - b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
    - c. Install wall track channel at perimeter.
- F. Installing Ceiling Bracing System:
  - 1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
  - 2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.



3. Brace suspended ceiling or soffit framing in seismic areas in accordance with ASTM E580.

G. Recessed Cubicle Curtain Track: Provide framing for recessed cubicle curtain track as indicated on Drawings.

**3.6 TOLERANCES**

A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.

B. Plumb and align vertical members within 3 mm (1/8-inch.)

C. Level or align ceilings within 3 mm (1/8-inch.)

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**SECTION 09 29 00**  
**GYPSUM BOARD**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies installation and finishing of gypsum board including GFRG access panels, and aluminum channels, trims and reveals incorporated into gypsum board surfaces.

**1.2 RELATED WORK**

- A. Aluminum channels, trims and reveals incorporated into architectural woodwork items: Section 06 40 00, ARCHITECTURAL WOODWORK.
- B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.
- C. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- D. Acoustical Insulation: Section 09 81 00, ACOUSTIC INSULATION.
- E. Recessed cubicle curtain track: Section 10 21 23, CUBICLE CURTAIN TRACK.

**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. GFRG access panels.
  - 4. Gypsum board, each type.
- C. Shop Drawings:
  - 1. Typical gypsum board installation, showing corner details, edge trim details and the like.
  - 2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
- D. Samples:
  - 1. Cornerbead.
  - 2. Edge trim.
  - 3. Control joints.

4. Aluminum channels, trims and reveals.

- E. Test Results:  
1. Sound rating test.

**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. ASTM International (ASTM):

B221-05a.....Aluminum and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Shapes, and Tubes

C11-08.....Terminology Relating to Gypsum and Related  
Building Materials and Systems

C475/C475M-02.....Joint Compound and Joint Tape for Finishing  
Gypsum Board

C840-08.....Application and Finishing of Gypsum Board

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

C1396/C1396M-06.....Gypsum Board

- C. Gypsum Association (GA)

GA-214-90.....Levels of Gypsum Board Finish

- D. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 501.....Metal Finishes Manual, Finishes for Aluminum

## **PART 2 - PRODUCTS**

### **2.1 BASIS-OF-DESIGN**

- A. Basis-Of-Design Products: The design of gypsum board assemblies is based on products specified in this Section. Subject to compliance with requirements, provide named product or a comparable product.

### **2.2 GYPSUM BOARD**

- A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.
- B. Water Resistant Gypsum Backing Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick.
- C. Special Acoustical Gypsum Board:
  - 1. Multi-layer engineered drywall panel composed of gypsum, viscoelastic sound-absorbing polymers and specially designed steel inner layers; 16 mm (5/8 inch) thickness; 1200 mm (48 inches) wide by maximum length to minimize number of joints.
  - 2. Product: Serious Materials Inc.'s "QuietRock 530"; or architect approved equal.
- D. Gypsum cores shall contain a minimum of 95 percent post industrial recycled gypsum content. Paper facings shall contain 100 percent post-consumer recycled paper content.

### **2.3 GLASS FIBER REINFORCED GYPSUM (GFRG) ACCESS PANEL**

- A. Description: Glass fiber reinforced gypsum access panel and frame, size as indicated on Drawings.
- B. Product: Wind-Lock's "Stealth Drop-In Access Panels"; or architect approved equal.

### **2.4 ACCESSORIES**

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.
- C. Aluminum Channels, trims and Reveals:
  - 1. Material: Extruded aluminum, ASTM B221, alloy 6063-T5.
  - 2. Manufacturer: Fry Reglet Corp.; Pittcon Industries; or architect approved equal.
  - 3. Configurations: Dimensions and configuration as indicated on Drawings.
  - 4. Accessories:
    - a. Reveal Molding: Fry DRM-625V-50.
    - b. Reveal Base. Fry DRMB-625-400
    - c. "F" Reveal: Fry FDM-625-50.
    - d. "W" Molding: Fry WDM-50-50.
  - 5. Provide connector clips to align trim during installation.
  - 6. Aluminum Finish: NAAMM AMP 501.
    - a. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.

## **2.5 ELECTRICAL BOX PADS**

- A. Non-Fire Rated Partitions:
  - 1. Description: 1/8 inch thick, 6 by 8 inch polybutene-butyl pads, self adhesive.
  - 2. Product: Lowery and Associates' "Lowery Outlet Box Pads"; or architect approved equal.

## **2.6 FASTENERS**

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.04 mm (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.

## **2.7 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 shown (FHP).
  - 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 100 mm (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.
- G. Walls:
  - 1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
  - 2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (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 except gypsum board shall be applied vertically over "Z" furring channels.
  - 5. For two-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 three-ply gypsum board assemblies, apply plies in same manner as for two-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 two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
  - 7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-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 9000 mm (30 feet).
    - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- H. Acoustical or Sound Rated Partitions:
  - 1. Cut gypsum board for a space approximately 3 mm to 6 mm (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. At acoustical or sound rated partitions attaché gypsum board only to resilient channels and not directly to studs.
  - 4. Special Acoustical Gypsum Board: Construct partitions surrounding Toilet Rooms using special acoustical gypsum board.
- I. GFRG Access Panels: Install panels with a seamless joint between access panel and adjacent gypsum board ceiling.

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 one 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 ELECTRICAL BOX PADS**

- A. Provide electrical box pads at outlet, switch, and telephones boxes in walls with acoustical insulation.
- B. Mold electrical box pad carefully around box after box is securely attached to studs and before gypsum board is installed.
- C. Take care to ensure that all openings are sealed with pad material. Leave no gaps.

**3.4 FINISHING OF GYPSUM BOARD**

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840.
- 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.
- D. Finish Gypsum Board Surface:
  1. Surfaces to Receive Paint: Meet requirements of GA-214 Level 4.
  2. Surfaces to be Concealed: Meet requirements of GA-214 Level 1.
  3. Surfaces to Receive Tile: Meet requirements of GA-214 Level 2.

**3.5 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 13 mm (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 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (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  
CERAMIC/PORCELAIN TILING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies ceramic tile, porcelain tile, and marble thresholds.

**1.2 RELATED WORK**

- A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS.
- B. Cementitious backer board at coved resinous flooring: Section 09 67 23 - RESINOUS FLOORING.
- C. Color and finish of field tile and trim shapes, and color of grout specified: Section 09 06 00, SCHEDULE OF FINISHES.

**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. Porcelain tile, each type, color, patterns and size.
  - 3. Wall (or wainscot) tile, each color, size and pattern.
  - 4. 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. Ceramic and porcelain tile, marked to show each type, size, and shape required.
  - 2. Dry-set Portland cement mortar and grout.
  - 3. Leveling compound.
  - 4. Commercial Portland cement grout.
  - 5. Organic adhesive.
- D. Certification:
  - 1. Master grade, ANSI A137.1.
  - 2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
    - a. Dry-set Portland cement mortar and grout.
    - b. Leveling compound.
    - c. Organic adhesive.

**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):
  - A108.4-2009.....Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesives
  - A108.5-2010.....Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
  - A108.10-2010.....Installation of Grout in Tilework
  - A118.7-2010.....High-Performance Cement Grouts for Tile Installation
  - A118.3-2009.....Chemical Resistant, Water Cleanable Tile-Setting Epoxy and Water Cleanable Tile-Setting and Grouting Epoxy Adhesive
  - A118.4-2010 ..... Latex-Portland Cement Mortar
  - A118.6-2010.....Standard Cement Grouts for Tile Installation
  - A136.1-2008.....Organic Adhesives for Installation of Ceramic Tile
  - A137.1-2008.....Ceramic Tile
- C. ASTM International (ASTM):
  - C109/C109M-11.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)
  - 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
  - C979-10.....Pigments for Integrally Colored Concrete
  - C1028-07.....Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method
- D. Tile Council of North America, Inc. (TCNA):
  - 2011.....Handbook for Ceramic, Glass, and Stone 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. 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.
- B. CT-1, Glazed Wall Tile:
  - 1. Face Size: 3 by 6 inches.
  - 2. Thickness: 0.35 inches.
  - 3. Color and finish as specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- C. CT-2, Glazed Wall Tile:
  - 1. Face Size: 6 by 12 inches.
  - 2. Thickness: 0.375 inches.
  - 3. Color and finish as specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- D. PT-1, Porcelain Paver Tile:
  - 1. Face Size: 11-5/8 by 23-3/8 inches.
  - 2. Thickness: 0.55 inches.
  - 3. Coefficient of Friction: 0.8 when tested in accordance with ASTM C1028.
  - 4. Color and finish as specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- E. PT-1, Porcelain Surface Bullnose Tile:
  - 1. Face Size: 2-7/8 by 17-3/8 inches.
  - 2. Thickness: 0.55 inches.
  - 3. Coefficient of Friction:
  - 4. Color and finish as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

### **2.2 SETTING MATERIALS OR BOND COATS**

- A. Conform to TCNA Handbook for Ceramic Tile Installation.
- B. Latex-Portland Cement Mortar, Dry Set: ANSI A118.4.
- C. Organic Adhesives: ANSI A136.1, Type 1.

### **2.3 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. Epoxy Grout: ANSI A118.3.

## **2.4 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 - 25 MPa (3500 psig) per ASTM C109/C109M.
  - 2. Flexural strength - 7 MPa (1000 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 38 mm (1-1/2 inches) thick without fillers and up to 100 mm (four 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.

## **2.5 MARBLE**

- A. Soundness Classification in accordance with MIA Design Manual III Groups.
- B. Thresholds:
  - 1. Group A, Minimum abrasive hardness (Ha) of 10.0 per ASTM C241.
  - 2. Honed finish on exposed faces.
  - 3. Thickness and contour as shown.
  - 4. One piece full width of door opening. Notch thresholds to match profile of door jambs.

## **2.6 WATER**

- A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

## **2.7 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.

# **PART 3 - EXECUTION**

## **3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain ambient temperature of work areas at not less than 16 degree C (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 38 degrees C (100 degrees F).

- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).
- E. Do not allow temperature to fall below 10 degrees C (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 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
  - 2. Not more than 1 in 1000 (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 in 400 (1/4 inch in eight feet) from required plane where Portland cement mortar setting bed is used.
  - 2. Not more than 1 in 800 (1/8 inch in eight 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.
    - 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. Additional preparation of concrete floors for tile set with epoxy, or furan-resin shall be in accordance with the manufacturer's printed instructions.

D. 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.

**3.4 MARBLE**

- A. Secure thresholds and stools in position with minimum of two stainless steel dowels.
- B. Set in dry-set Portland cement mortar or latex-Portland cement mortar bond coat.
- C. Set threshold to finish 12mm (1/2 inch) above ceramic tile floor unless shown otherwise, with bevel edge joint top flush with adjacent floor similar to TCNA detail TR611-02.

**3.5 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 TCNA Installation Guidelines:
- C. 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.
  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 200 mm (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 reveals of openings with tile, except where other finish materials are shown or specified.
    - c. At window openings, provide tile stools and reveals, except where other finish materials are shown or specified.

- d. 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 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
  - c. Make joints in Paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.

**3.6 THIN SET PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT**

- A. Installation of Tile: ANSI A108.1, except as specified otherwise.

**3.7 THIN SET CERAMIC TILE INSTALLED WITH ORGANIC ADHESIVE**

- A. Installation of Tile: ANSI A108.1.

**3.8 GROUTING**

- A. Grout Type and Location:
  - 1. Grout for glazed ceramic wall tile and porcelain floor tile in epoxy grout.
- B. Workmanship:
  - 1. Install and cure grout in accordance with ANSI A108.1.

**3.9 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 epoxy, furan and commercial Portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

**3.10 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 9 mm (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.

**3.11 TESTING FINISH FLOOR**

- A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

- - - E N D - - -

**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: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 QUALITY CONTROL**

- A. Qualifications:
  - 1. Approval required of products or service of proposed manufacturer, suppliers and installers, and shall be based upon submission by Contractor of certification that:
  - 2. Manufacturer regularly and presently, manufactures and installs acoustical ceiling systems and related accessories as one of its principal products and has a record of successful in-service performance.
  - 3. Accessories required for acoustical ceiling systems shall be manufacturer's standard or other systems compatible with acoustical ceiling system manufacturer's material, and acceptable to acoustical ceiling system manufacturer. Items shall be of materials and construction which shall provide desired functional service.
- B. Installer: Approved in writing by manufacturer.
- C. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).
  - 1. Sprinkler heads and light fixtures: Shall typically penetrate center of a panel width.
  - 2. HVAC Air Outlets and Inlets: Shall be planned to occur within center of panel systems or provide for equal distance on each side parallel to length of panels.
- D. Seismic Design: Design suspension system for seismic considerations under direct supervision of Professional Structural Engineer experienced in design of this work and licensed in the State of California.

**1.4 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.
  - 2. Colored markers for units providing access.



- C. Manufacturer's Literature and Data:
  - 1. Ceiling suspension system, each type, showing complete details of installation.
  - 2. Acoustical units, each type.
- D. Shop Drawings:
  - 1. Submit complete composite fabrication, and installation shop drawings including associated components.
  - 2. Identify panel sections, edge trim, lighting trim, air diffuser sections and trim, sprinkler head locations and trim, other component parts, not included in manufacturer's product data, by name and material and showing design, construction, installation, and anchorage.
  - 3. Layout and installation details, including relation to adjacent work such as walls and bulkheads.
  - 4. Composite Reflected Ceiling Plans, at 1:50 (1/4 inch) scale, showing location of all accessories, mechanical and electrical components. Indicate following:
    - a. Joint pattern.
    - b. Ceiling suspension members.
    - c. Method of attaching hangers to building structure.
    - d. Ceiling-mounted items including light fixtures, air outlets and inlets, speakers, sprinkler heads, and access panels. Special moldings at walls, column penetrations, and other junctures with adjoining construction.
  - 5. Detail sections of typical composite members, at wall surfaces, mechanical diffusers and grilles, sprinkler heads, and light fixtures.
  - 6. Provisions for expansion and contraction.
  - 7. Anchors and reinforcements.
- E. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

## 1.5 DEFINITIONS

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM E1264.

## 1.6 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. ASTM International (ASTM):
  - A641/A641M-03.....Zinc-coated (Galvanized) Carbon Steel Wire
  - 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
E580-06.....	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
E1111-07.....	Measuring the Interzone Attenuation of Open Office Components
E1477-98a(2008).....	Luminous reflectance Factor of Acoustical materials by Use of Integrating-Sphere Reflectometers
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 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.
- B. Exposed grid suspension system for support of lay-in panels:
  - 1. Exposed grid width not less than 22 mm (7/8 inch) with not less than 8 mm (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 specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.

### **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 9 mm (3/8 inch) wide strip.

### **2.3 WIRE**

- A. ASTM A641.
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).
- C. For bracing wires: Minimum diameter 3.43 mm (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:**

1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
2. Flush ceiling insert type:
  - a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
  - b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
  - c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.

**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 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled Kg      Pound	Hot-rolled Kg      Pound
38	1 1/2	215.4   475	508    1120
50	2	267.6   590	571.5   1260

**2.6 ACOUSTICAL UNITS**

- A. AP-1 - Mineral base panel with, minimum 3/4 inch thick, with humidity resistance.
  1. Surface Texture: Fine.
  2. ASTM E1264, Type XII, Form 2, Pattern E.
  3. Flame Spread, ASTM E1264: 25 or less.
  4. Light Reflectance (LR), ASTM E1477: 0.90.
  5. Articulation Class (CAC), ASTM E1111: 180.
  6. Noise Reduction Coefficient (NRC), ASTM C423: 0.90.
  7. Edge Profile: Square.
  8. Size: 24 by 24 inches.
- B. AP-2 - Mineral base panel with, minimum 1 inch thick, with humidity resistance.
  1. Surface Texture: Fine.
  2. ASTM E1264, Type XII, Form 2, Pattern E.
  3. Flame Spread, ASTM E1264: 25 or less.
  4. Light Reflectance (LR), ASTM E1477: 0.90.
  5. Articulation Class (CAC), ASTM E1111: 180.
  6. Noise Reduction Coefficient (NRC), ASTM C423: 0.90.
  7. Edge Profile: Square.
  8. Sizes: As indicated on Drawing.

## **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, 6 to 9 mm (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 INSPECTION**

- A. Ceiling Areas: Conform with details, dimensions, and tolerances shown on manufacturer's approved acoustical ceiling system composite reflected ceiling plan shop drawings.
- B. Conditions which may adversely affect acoustical ceiling system installation shall be brought to Contractors attention, for repair, prior to commencement of acoustical ceiling system installation. Do not start ceiling installation until affected area has been repaired to Installer's satisfaction.

### **3.2 PREPARATION**

- A. Measure each ceiling area and establish layout of acoustical ceiling units to balance border widths at opposite edges of each ceiling. Avoid using units less than half wide at borders. Comply with composite reflected ceiling plan requirements.

### **3.3 CEILING TREATMENT**

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (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.

### 3.4 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 1.48 m<sup>2</sup> (16 sf) 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 one 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 100 mm (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 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

#### B. Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.

#### C. Anchorage to Structure:

1. Concrete:
  - a. Install hanger inserts and wire loops required for support of hanger and bracing wire in concrete forms before concrete is placed. Install hanger wires with looped ends through steel deck if steel deck does not have attachment device.
  - b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.

#### D. 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, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

#### E. Indirect Hung Suspension System:

1. As illustrated in ASTM C635.
2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (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.

#### F. Seismic Ceiling Bracing System:

1. Construct system in accordance with ASTM E580.
2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

- G. Perimeter Trim: Install in accordance with manufacturer's printed instructions and ASTM C636.

### **3.5 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 6 mm (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. Attach marker on exposed ceiling surface of upward access acoustical unit.

### **3.6 CLEAN-UP AND COMPLETION**

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects.

-- - E N D - - -

**SECTION 09 65 13  
RESILIENT BASE AND ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the installation of rubber base (RB-1).

**1.2 RELATED WORK**

- A. Profile and Color: Section 09 06 00, SCHEDULE FOR FINISHES.

**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: 150 mm (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 publication 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. ASTM International (ASTM):
- F1861-08.....Resilient Wall Base

## **PART 2 - PRODUCTS**

### **2.1 RESILIENT BASE (RB-1)**

- A. Description:
  - 1. Contoured rubber, top set cove, ASTM F1861 Type TP and Group 1.
  - 2. Height: As scheduled in the Drawings.
  - 3. Accessories: Preformed external and end stops.
- B. Profile and Color: Refer to Section 09 06 00, SCHEDULE FOR FINISHES

### **2.2 ADHESIVES**

- A. Adhesive must meet the following requirements:
  - 1. Solvent-free, water-resistant, mildew-resistant, non-flammable, low odor adhesive to suit resilient sheet floor covering and substrate conditions indicated
  - 2. Have VOC content of less than 100 g/L.
  - 3. Meet all applicable air quality requirements
  - 4. Recommended by resilient base manufacturer.

## **PART 3 - EXECUTION**

### **3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials above 21° C (70 °F), for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°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 Resident Engineer.
- B. Submit proposed installation deviation from this specification to the Resident Engineer indicating the differences in the method of installation.
- C. The Resident Engineer 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 3 mm (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 600 mm (24 inches) 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. 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. Clean and polish materials in the following order:
  - 1. After two weeks, scrub resilient bases 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.

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**SECTION 09 65 16  
RESILIENT SHEET FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the installation of rubber sheet flooring (RSF-1, RSF-2, and RSF-3) and accessories.
- B. Installation of sheet flooring including following:
  - 1. Heat welded seams.
  - 2. Integral cove base: Installed at intersection of floor and vertical surfaces.

**1.2 RELATED WORK**

- A. Color, pattern, and texture: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 QUALITY CONTROL-QUALIFICATIONS**

- A. The Contracting Officer's Technical Representative 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 three installations similar and equivalent in size to this project for three years. Submit list of installations.
- B. The rubber 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 rubber floor coverings shall meet physical performance characteristics as determined by testing products, per ASTM test method, indicated below:
  - 1. Exceeds static coefficient of friction of > 0.5 per ASTM D2047.
  - 2. Exceeds minimum ADA requirements of 0.6 static coefficient of friction per ASTM F1678.
  - 3. Static Load Limit: 3445 kPa (500 psi) per ASTM F970.
- D. The floor covering manufacturer shall certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

**1.4 SUBMITTALS**

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

- 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, 38 mm by 300 mm (1-1/2 inch by 12 inch), of each color and pattern with a welded seam using proposed welding rod.
  - 2. Cap strip and fillet strip, 300 mm (12 inches) for integral base.
  - 3. 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.
  - 4. Certificates: Quality Control Certificate Submittals and lists specified in Article, QUALITY CONTROL-QUALIFICATIONS.

#### **1.5 PROJECT CONDITIONS**

- A. Maintain temperature of floor materials and room, where work occurs, above 18 ° C (65 °F) and below 38 °C (100 °F) for 48 hours before, during and for 48 hours after installation. After above period, room temperature shall not fall below 13 °C (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. Store materials in weather tight 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.
- C. Move sheet 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 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.
  - E662-09.....Specific Optical Density of Smoke Generated by Solid Materials

F710-11.....Practice for Preparing Concrete Floors and Other  
Monolithic Floors to Receive Resilient Flooring.

C. Resilient Floor Covering Institute (RFCI):

RFCI MRP-95.....Addressing Moisture Related Problems Relevant to  
Resilient Floor Coverings Installed Over  
Concrete.

**1.8 SCHEDULING**

- A. Interior finish work such as plastering, drywall finishing, concrete, 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 GUARANTY**

- A. Submit written guaranty, in accordance with General Condition requirements except that guarantee period shall be extended to include two years.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Basis-of-Design Products: The design of sheet flooring is based on products specified in this Section. Subject to compliance with requirements, provide named product or a comparable product.
- B. Furnish product type, materials of the same production run and meeting following criteria.
- C. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.
- D. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
- E. Smoke density: Less than 450 per ASTM E662.

**2.2 SHEET RUBBER FLOOR COVERING (RSF-1, RSF-2, AND RSF-3)**

- A. Description:
1. Size: 1.9 m (74 inches) wide
  2. Thickness: 3 mm (1/8 inch).
  3. Color and pattern uniformly distributed throughout tile.
- B. Product: Artigo USA's "Kayar"; or architect approved equal.

**2.3 WELDING ROD**

- A. Product of floor covering manufacturer in color shall match field color of sheet vinyl covering.

## **2.4 APPLICATION MATERIALS AND ACCESSORIES**

- A. 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.
- B. Adhesive: Adhesive must meet the following requirements:
  - 1. Solvent-free, water-resistant, mildew-resistant, non-flammable, low odor adhesive to suit resilient sheet floor covering and substrate conditions indicated
  - 2. Have VOC content of less than 100 g/L.
  - 3. Meet all applicable air quality requirements
  - 4. Recommended by resilient base manufacturer.
- C. Base Accessories:
  - 1. Fillet Strip: 19 mm (3/4 inch) radius fillet strip compatible with resilient sheet material.
  - 2. Cap Strip: Extruded flanged zero edge vinyl reducer strip approximately 25 mm (one inch) exposed height with 13 mm (1/2 inch) flange.

## **PART 3 - EXECUTION**

### **3.1 SUBFLOOR PREPARATION**

- A. Verify that concrete slabs comply with ASTM F710.
- B. Concrete Subfloor Testing:
  - 1. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Resilient Floor Covering Institute recommendations in manual RFCI-MRP.
  - 2. Test for proper bond (adhesion) of each flooring material to determine compatibility of resilient flooring adhesives to concrete after removal of curing agents, breaker compounds, dust inhibitors, oil, grease, paint and other special surface treatments and conditions.
  - 3. The results of above tests must be within flooring manufacturer's acceptable criteria.
- C. 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.
- D. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy remove of tile.
- E. Correct conditions which will impair proper installation.
- F. 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.
- G. Fill cracks, joints 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 joints.
- H. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing cleaning agents.
- I. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the flooring or adhesive manufacturers.
- J. Preparation of existing installation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives.

### **3.2 INSTALLATION OF FLOORING**

- A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.
- B. Maintain uniformity of sheet 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 150 mm (6 inches) away from parallel joints in flooring substrates.
- D. Match edges of sheet floor coverings for color shading and pattern at seams.
- E. Where sheet floor covering abuts other flooring material floors shall finish level.
- F. Extend sheet floor coverings into toe spaces, door reveals, closets, and similar openings.

### **3.3 INSTALLATION OF INTEGRAL COVERED BASE**

- A. Set preformed cove to receive base. Install base material with adhesive and terminate exposed edge with cap strip. Integral base shall be 100 mm (4 inches) high unless otherwise indicated.
- B. Internal and external corners shall be formed to geometric shape generated by cove at either square or radius corners.

### **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. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.
- B. Vacuum floor thoroughly.
- C. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.
- D. Upon completion, Resident Engineer shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- E. Perform initial maintenance according to flooring manufacturer's written recommendations.
- F. Keep traffic off resilient material for a minimum 72 hours after installation.

### **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.

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**SECTION 09 65 19  
RESILIENT TILE FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the installation of rubber tile flooring (RTF) and accessories.

**1.2 RELATED WORK**

- A. Color and pattern and location in room finish schedule: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

**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. Resilient material manufacturer's recommendations for adhesives, underlayment, and primers.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Tile: 300 mm by 300 mm (12 inches by 12 inches) for each type, pattern and color.
  - 2. Transition Strips: 150 mm (6 inches) long, each type.
- D. Shop Drawings:
  - 1. Layout of patterns shown on the drawings and in Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Transition strip locations showing types and detail cross sections.

**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 weathertight and dry storage facility.
- B. Protect from damage from handling, water, and temperature.

**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. ASTM International (ASTM):

- E648-10.....Critical Radiant Flux of Floor Covering Systems  
Using a Radiant Energy Source
- E662-09.....Specific Optical Density of Smoke Generated by  
Solid Materials
- E1155-96 (R2008).....Determining Floor Flatness and Floor Levelness  
Numbers

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Basis-of-Design Products: The design of sheet flooring is based on products specified in this Section. Subject to compliance with requirements, provide named product or a comparable product.
- B. Furnish product type, materials of the same production run and meeting following criteria.
- C. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.
- D. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
- E. Smoke density: Less than 450 per ASTM E662.

**2.2 RUBBER TILE {RTF-1}**

- A. Description:
  - 1. Size: 610 mm (24 inches) square
  - 2. Thickness: 3 mm (1/8 inch).
  - 3. Color and pattern uniformly distributed throughout tile.
- B. Product: Artigo USA's "Kayar"; or architect approved equal.

**2.3 ADHESIVES**

- A. Adhesive must meet the following requirements:
  - 1. Solvent-free, water-resistant, mildew-resistant, non-flammable, low odor adhesive to suit resilient sheet floor covering and substrate conditions indicated
  - 2. Have VOC content of less than 100 g/L.
  - 3. Meet all applicable air quality requirements
  - 4. Recommended by resilient tile manufacturer.

**2.4 PRIMER (FOR CONCRETE SUBFLOORS)**

- A. As recommended by the adhesive and tile manufacturer.

**2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.
- B. Determine the type of underlayment selected for use by the condition to be corrected.

## **2.6 TRANSITION STRIP**

- A. Aluminum, mill finish, mechanically cleaned:
  - 1. Drill and counter sink edge strip for flat head screws.
  - 2. Space holes near ends and approximately 225 mm (9 inches) on center between.

## **2.7 SCREWS**

- A. Stainless steel flat head screw.

# **PART 3 - EXECUTION**

## **3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials a minimum of 22 °C (70 °F,) for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs between 21 °C and 27 °C (70 °F and 80 °F), for at least 48 hours, before, during and after installation.
- C. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

## **3.2 SUBFLOOR PREPARATION**

- A. Verify that concrete slabs comply with ASTM F710. At existing slabs, determine levelness by F-number method in accordance with ASTM E1155. Overall value shall not exceed as follows:  
FF30/FL20
- B. Correct conditions which will impair proper installation.
- C. Fill cracks, joints 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 joints.
- D. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing cleaning agents.
- E. Concrete Subfloor Testing:
  - 1. Determine Adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MRP.
- F. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy removal of tile.
- G. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the tile or adhesive manufacturers.

- H. Preparation of existing installation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives.

### **3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.
- B. Mix tile from at least two containers. An apparent line either of shades or pattern variance will not be accepted.
- C. Tile Layout:
  - 1. If layout is not shown on drawings, lay tile symmetrically about center of room or space with joints aligned.
  - 2. No tile shall be less than 150 mm (6 inches) and of equal width at walls.
  - 3. Place tile pattern in the same direction; do not alternate tiles.
- D. Trim tiles to touch for the length of intersections at pipes and vertical projections, seal joints at pipes with waterproof cement.
- E. Application:
  - 1. Apply adhesive uniformly with no bare spots.
  - 2. Roll tile floor with a minimum 45 kg (100 pound) roller. No exceptions.
  - 3. The Resident Engineer may have test tiles removed to check for non-uniform adhesion, spotty adhesive coverage, and ease of removal. Install new tile for broken removed tile.
- F. Installation of Transition Strips:
  - 1. Locate transition strips under center line of doors unless otherwise shown.
  - 2. Set transition strips in adhesive. Anchor metal edge strips with anchors and screws specified.
  - 3. Where tile edge is exposed, butt edge strip to touch along tile edge.
  - 4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

### **3.4 CLEANING AND PROTECTION**

- A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.
- B. Keep traffic off resilient material for a minimum 72 hours after installation.
- C. Clean materials in the following order:
  - 1. For the first two weeks sweep and damp mopped only.
  - 2. After two weeks, scrub resilient materials with a minimum amount of water and a mild detergent. Leave surface clean and free of detergent residue.
- D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by Resident Engineer. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by Resident Engineer.

- E. When protective materials are removed and immediately prior to acceptance, replace any damage tile, re-clean resilient materials, lightly re-apply polish and buff floors.

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**SECTION 09 67 23  
RESINOUS FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies a seamless resinous flooring system (EF-1) with integral cove base and cementitious backer board.

**1.2 RELATED WORK**

- A. Color and location of resinous flooring: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Floor Drains: Division 22, 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. Description of each product to be provided.
  - 2. Application and installation instructions.
  - 3. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.
- C. Qualification Data: For Installer.
- D. Sustainable Submittal:
  - 1. Product data for products having recycled content, submit documentation indicating percentages by weight of postconsumer and pre consumer recycled content.
    - a. Include statements indicating costs for each product having recycled content, and low emitting materials.
  - 2. Product data for Environmental Quality Credit EQ 4.2 low emitting materials, include printed statement of VOC content indicating compliance with environmental requirements.
  - 3. Product data for Material Resource Credit MR 4.1, 12%-35% post-consumer recycled glass content.
- E. Samples:
  - 1. Each color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Samples for verification: For each (color and texture) resinous flooring system required, 6 inches (152 mm) square, applied to a rigid backing by installer for this project.
  - 3. Sample showing construction from substrate to finish surface in thickness specified and color and texture of finished surfaces. Finished flooring must match the approved samples in color and texture.
- F. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:
  - 1. Patterns.
  - 2. Edge configuration.

G. Certifications and Approvals:

1. Manufacturer's certification of material and substrate compliance with specification.
2. Manufacturer's approval of installer.
3. Contractor's certificate of compliance with Quality Assurance requirements.

H. Warranty: As specified in this section.

**1.4 QUALITY ASSURANCE**

A. Manufacture Certificate: Manufacture shall certify that a particular resinous flooring system has been in use for a minimum of (5) five years.

B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this project for a minimum period of five years, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
2. Contractor shall have completed at least five projects of similar size and complexity. Include list of at least five projects. List must include owner (purchaser); address of installation, contact information at installation project site; and date of installation.
3. Installer's Personnel: Employ persons trained for application of specified product.

C. Source Limitations:

1. Obtain primary resinous flooring materials including primers, resins, hardening agents, grouting coats and finish or sealing coats from a single manufacturer.
2. Provide secondary materials, including patching and fill material, joint sealant, and repair material of type and from source recommended by manufacturer of primary materials.

D. Pre-Installation Conference:

1. Convene a meeting not less than thirty days prior to starting work.
2. Attendance:
  - a. Contractor
  - b. VA Resident Engineer
  - c. Manufacturer and Installer's Representative
3. Review the following:
  - a. Environmental requirements
    - 1) Air and surface temperature
    - 2) Relative humidity
    - 3) Ventilation
    - 4) Dust and contaminants
  - b. Protection of surfaces not scheduled to be coated
  - c. Inspect and discuss condition of substrate and other preparatory work performed
  - d. Review and verify availability of material; installer's personnel, equipment needed
  - e. Edge conditions.
  - f. Performance of the coating with chemicals anticipated in the area receiving the resinous (epoxy resin composition) flooring system
  - g. Application and repair
  - h. Field quality control

- i. Cleaning
  - j. Protection of coating systems
  - k. One-year inspection and maintenance
  - l. Coordination with other work
- E. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of resinous flooring systems.
- F. Contractor Job Site Log: Contractor shall document daily; the work accomplished environmental conditions and any other condition event significant to the long term performance of the resinous flooring systems installation. The Contractor shall maintain these records for one year after Substantial Completion.

#### **1.5 MATERIAL PACKAGING DELIVERY AND STORAGE**

- 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. Protect materials from damage and contamination in storage or delivery, including moisture, heat, cold, direct sunlight, etc.
- C. Maintain temperature of storage area between 60 and 80 degrees F (15 and 26 degrees C).
- D. Keep containers sealed until ready for use.
- E. Do not use materials beyond manufacturer's shelf life limits.
- F. Package materials in factory pre-weighed and in single, easy to manage batches sized for ease of handling and mixing proportions from entire package or packages. No On site weighing or volumetric measurements are allowed

#### **1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring applications.
  - 1. Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

## 1.7 WARRANTY

- A. Work subject to the terms of the Article "Warranty of Construction" FAR clause 52.246-21.
- B. Warranty: Manufacture shall furnish a single, written warranty covering the full assembly for both material and workmanship for a extended period of three full years from date of installation, or provide a joint and several warranty signed on a single document by manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of three full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

## 1.8 APPLICABLE PUBLICATIONS

- A. The publication 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):
  - A108.11-1999.....Interior Installation of Cementitious Backer Units
- C. ASTM International (ASTM):
  - B221-08.....Standard Specification for Aluminum and Aluminum-Alloy, Extruded Bars, Rods, Wire, Profiles and Tubes
  - C580-02(2008).....Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
  - C948-81(2009).....Dry and Wet Bulk density, Water Absorption, and Apparent Porosity of thin Sections of Glass-Fiber Reinforced Concrete
  - C954-04.....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
  - D638-10.....Standard Test Method for Tensile Properties of Plastics
  - D2240-05.....Standard Test Method for Rubber Property – Durometer Hardness
  - E648-10e1.....Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
- D. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500-06.....Finishes for Aluminum



## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Basis-of-Design Products: The design of sheet flooring is based on products specified in this Section. Subject to compliance with requirements, provide named product or a comparable product

### **2.2 SYSTEM DESCRIPTION FOR RESINOUS FLOORING**

- A. Descriptions: The resinous flooring consists of the following components.
  - 1. Waterproof membrane.
  - 2. Undercoat.
  - 3. Aggregate.
  - 4. Sealer.
- B. Product: Stonhard's "Stongard HD"; or architect approved equal.

### **2.3 SYSTEM COMPONENTS**

- A. Waterproof Membrane:
  - 1. Description: Two-components, free-flowing, 100 percent solids, urethane, elastomeric waterproof membrane.
  - 2. Product: Stonhard's "Stanproof ME7"; or architect approved equal.
- B. Undercoat:
  - 1. Description: Three-component, free-flowing, epoxy formulation consisting of resin, curing agent and fine aggregate.
  - 2. Product: Stonhard's "Stanshield Undercoat"; or architect approved equal.
- C. Aggregate:
  - 1. Description: Brightly. Colored, quartz broadcast aggregate/
  - 2. Product: Stonhard's "Stanshield Aggregate"; or architect approved equal.
- D. Sealer:
  - 1. Description: Two-component, high performance, UV resistant, clear epoxy sealer.
  - 2. Product: Stonhard's Stankote CE4"; or architect approved equal.
- E. System Characteristics:
  - 1. Color and Pattern: As indicated in Section 09 06 00, SCHEDULE OF FINISHES.
  - 2. Integral cove base: 1 inch (25.4 mm) radius undercoat cove. Verify cove base installation with manufacturer's system.
  - 3. Nominal System Thickness: 1/8 inch (3 mm), verify thickness as systems vary by manufacturer.
  - 4. Finish: Textured anti-slip resistant to meet or exceed 0.06 dry; 0.08 wet.

**F. Physical Properties:****1. Physical Properties of flooring system when tested as follows:**

Property	Test	Value
Volatile Organic Compound Limits (V.O.C.)	EPA & LEED	Below 100 g/l
Flexural Strength	ASTM C580	1,900 psi
Tensile Strength	ASTM D638	1,300 psi
Hardness Shore D	ASTM D2240	85 to 90
Flammability	ASTM E648	Class A

**2.4 BASE CAP STRIP**

- A. Aluminum, Extruded: ASTM B221, Alloy 6063-T6.
- B. Shape for 5 mm (3/16 inch) depth of base material, "J" configuration.
- C. Finish:
  - 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
  - 2. Aluminum: NAAMM Amp 500:
    - a. Clear anodic coating, AA-C22A41 chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
    - b. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.

**2.5 CEMENTITIOUS BACKER UNITS**

- A. Use in showers or wet areas.
- B. ANSI A118.9.
- C. Use Cementitious backer units in maximum available lengths.
- D. Backer unit meet or exceed the following additional physical properties:

Property	Test Method	Value
Water absorption	ASTM C948	Less than 20 percent by weight

**2.6 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS**

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A118.4.
- C. Joint material, including reinforcing tape, and tape embedding material, shall be as specifically recommended by the backer unit manufacturer.

**2.7 SUPPLEMENTAL MATERIALS**

- A. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service or joint conditioned indicated.

- B. Screws for Cementitious Backer Units.
  - 1. Standard screws for gypsum board are not acceptable.
  - 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
  - 3. ASTM C954 for steel 1 mm (0.033 inch) thick.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION**

- A. Examine the areas and conditions where monolithic resinous flooring system with integral base is to be installed with the VA Resident Engineer.

#### **3.2 PROJECT CONDITIONS**

- A. Maintain temperature of rooms (air and surface) where work occurs, between 70 and 90 degrees F (21 and 32 degrees C) for at least 48 hours, before, during, and 24 hours after installation. Maintain temperature at least 70 degrees F (21 degrees C) during cure period.
- B. Maintain relative humidity less than 75 percent.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.
- D. Maintain proper ventilation of the area during application and curing time period.
  - 1. Comply with infection control measures of the VA Medical Center.

#### **3.3 INSTALLATION REQUIREMENTS**

- A. The manufacturer's instructions for application and installation shall be reviewed with the VA Resident Engineer for the seamless resinous flooring system with integral cove base //and trench liner//.
- B. Substrate shall be approved by manufacture technical representative.

#### **3.4 PREPARATION**

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
  - 1. Prepare concrete substrates as recommended by resinous flooring manufacture.
  - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
  - 3. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for flooring manufacturer recommended joint fill material, and concrete crack treatment.
- F. Prepare wall to receive integral cove base:
  - 1. Verify wall material is acceptable for resinous flooring application, if not, install material (e.g. cement board) to receive base.
  - 2. Fill voids in wall surface to receive base, install undercoats (e.g. water proofing membrane, and/or crack isolation membrane) as recommended by resinous flooring manufacturer.
  - 3. Install base prior to flooring if required by resinous flooring manufacturer.
  - 4. Grind, cut or sand protrusions to receive base application.

### 3.5 APPLICATION

- A. **General:** Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
  - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum inter-coat adhesion.
  - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  - 3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
    - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Membrane:
  - 1. Mix material according to resinous flooring manufacturer's recommended procedures.
  - 2. Apply over prepared substrate at resinous flooring manufacturer's recommended spreading rate.
  - 3. Apply primer if resinous flooring manufacturer requires.
- C. Coved Base:
  - 1. 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 A108.11 except as specified otherwise.
    - c. Install units 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 200 mm (eight inches) on center and not closer than 13 mm (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. Do not install joint treatment for seven days after installation of cementitious backer unit.
  - f. 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 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.
  - 2. Trowel resinous flooring to wall surfaces at a 25 mm (1 inch) radius, before applying flooring. Apply according to resinous flooring manufacturer's written instructions and details including those for taping, mixing, priming, and troweling, sanding, and top coating of cove base. Round internal and external corners.
- D. Underlayment:
- 1. Mix material according to resinous flooring manufacturer's recommended procedures.
  - 2. Uniformly spread underlayment over membrane with strict adherence to resinous flooring manufacturer's installation procedures and coverage rates.
- E. Aggregate: Apply aggregate with strict adherence to manufacturer's installation procedures.
- F. Sealer: Mix and apply the sealer with strict adherence to resinous flooring manufacturer's installation procedures and coverage rates.

### **3.6 CURING, PROTECTION AND CLEANING**

- A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process.
- B. Close area of application for a minimum of 24 hours.
- C. Protect resinous flooring materials from damage and wear during construction operation.
  - 1. Cover flooring with kraft type paper.
  - 2. Optional 6 mm (1/4 inch) thick hardboard, plywood, or particle board where area is in foot or vehicle traffic pattern, rolling or fixed scaffolding and overhead work occurs.
- D. Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

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**SECTION 09 81 00**  
**ACOUSTICAL INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies acoustical insulation for buildings.

**1.2 RELATED WORK**

- A. Safing insulation: Section 07 84 00, FIRESTOPPING.

**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

**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):
- C665-06.....Mineral Fiber Blanket Thermal Insulation for  
Light Frame Construction and Manufactured  
Housing
- E84-08.....Surface Burning Characteristics of Building  
Materials

**PART 2 - PRODUCTS**

**2.1 INSULATION - GENERAL**

- A. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Glass fiber reinforced	6 percent recovered material

The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

## **2.2 ACOUSTICAL INSULATION:**

- A. Glass Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
- B. Thickness as shown; of widths and lengths to fit tight against framing.

## **2.3 ADHESIVE**

- A. As recommended by the manufacturer of the insulation.

## **2.4 TAPE**

- A. Pressure sensitive adhesive on one face.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION - GENERAL**

- A. Install batt or blanket insulation with tight joints and filling framing void completely.
- 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.

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**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. Prefinishing wood paneling with transparent and opaque finishes: Section 06 40 00, ARCHITECTURAL WOODWORK.
- B. Prefinished flush doors with transparent finishes: Section 08 14 00, WOOD DOORS.
- C. Type of Finish, Color, and Gloss Level of Finish Coat: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Shop prime painting of steel and ferrous metals: Division 08 - OPENINGS, Division 22 - PLUMBING, Division 26 - ELECTRICAL, and Division 27 - COMMUNICATIONS

**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. 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, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
  - 3. Attach labels to panel stating the following:
    - a. Federal Specification Number or manufacturers name and product number of paints used.
    - b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
    - c. Product type and color.
    - d. Name of project.



4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (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 18 and 30 degrees C (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 9 m<sup>2</sup> (100 ft<sup>2</sup>), selected by Contracting Officer's Technical Representative.

B. Finish and texture approved by Contracting Officer's Technical Representative 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-1992.....Threshold Limit Values (TLV) for Chemical  
Substances and Physical Agents and Biological  
Exposure Indices (BEIs)

ACGIH TLV-DOC.....Documentation of Threshold Limit Values and  
Biological Exposure Indices, (Sixth Edition)

C. American National Standards Institute (ANSI):

A13.1-96.....Scheme for the Identification of Piping Systems

D. Commercial Item Description (CID):

A-A-1272.....Plaster, Gypsum (Spackling Compound)

E. Federal Specifications (Fed Spec):

TT-F-322D.....Filler, Two-Component Type, For Dents, Cracks

F. Master Painters Institute (MPI):

No. 9-07.....Exterior Alkyd Enamel MPI Gloss Level 6 (EO}

No. 18-07.....Organic Zinc Rich Primer

No. 22-07.....Aluminum Paint, High Heat (up to 590° - 1100F)  
(HR)

No. 45-07.....Interior Primer Sealer

No. 46-07.....Interior Enamel Undercoat

No. 47-07.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)

No. 50-07.....Interior Latex Primer Sealer

No. 95-07.....Fast Drying Metal Primer

No. 134-07.....Primer, Galvanized, Water Based

No. 135-07.....Non-Cementitious Galvanized Primer

No. 143-07.....Institutional Low Order/VOC Interior Latex, Flat  
MPI Gloss Level 1

No. 144-07.....Institutional Low Order/VOC Interior Latex MPI  
Gloss Level 2

No. 147-07.....Institutional Low Order/VOC Interior Latex, Semi-  
Gloss MPI Gloss Level 5

G. Steel Structures Painting Council (SSPC):

SSPC SP 1-00 (R2004)....Solvent Cleaning

SSPC SP 2-00 (R2004)....Hand Tool Cleaning

SSPC SP 3-00 (R2004)....Power Tool Cleaning

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Plastic Tape:
  - 1. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.
  - 2. Pressure sensitive adhesive back.
  - 3. Widths as shown.
- B. Identity markers options:
  - 1. Pressure sensitive vinyl markers.
  - 2. Snap-on coil plastic markers.
- C. Organic Zinc Rich Primer: MPI 18.
- D. Organic Zinc rich Coating (HR): MPI 22.
- E. Interior Enamel Undercoat: MPI 46.
- F. Interior Alkyd, Semi-Gloss (AK): MPI 47.
- G. Interior Latex Primer Sealer: MPI 50.
- H. Fast Drying Metal Primer: MPI 95.
- I. Waterborne Galvanized Primer: MPI 134.
- J. Non-Cementitious Galvanized Primer: MPI 135.
- K. Institutional Low Order/VOC Interior Latex, Flat MPI Gloss Level 1: MPI 143.
- L. Institutional Low Order/VOC Interior Latex, MPI Gloss Level 2: MPI 144.
- M. Institutional Low Order/VOC Interior Latex, Semi-Gloss MPI Gloss Level 5: MPI 147.

### **2.2 PAINT PROPERTIES**

- A. Use ready-mixed (including colors), except two 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.

### **2.3 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 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
  - 2. Lead-Base 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. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons 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 3 degrees C (5 degrees F) above dew point.
    - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (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. Do no exterior painting when it is windy and dusty.
  - 4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
  - 5. 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.
    - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.
  - 6. Varnishing:
    - a. Apply in clean areas and in still air.
    - b. Before varnishing vacuum and dust area.
    - c. Immediately before varnishing wipe down surfaces with a tack rag.

#### **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. Wipe surface with a tack rag prior to applying finish.

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, Copper and Copper Alloys 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. 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 25 mm (1-inch) in diameter as specified in Section for 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 two component and two 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 three coats; prime, body, and finish. When two 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 applications of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Contracting Officer's Technical Representative.
- 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 Contracting Officer's Technical Representative, except in spaces sealed from existing occupied spaces.
- 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. 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. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating (HR)).

F. Gypsum Board:

1. Surfaces to receive MPI 143 (Institutional Low Order/VOC Interior Latex, Flat MPI Gloss Level 1), or MPI 147 (Institutional Low Order/VOC Interior Latex, Semi-Gloss MPI Gloss Level 5) finish: Use MPI 50 (Interior Latex Primer Sealer).
2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 46 (Interior Enamel Undercoat) in shower and bathrooms.
3. Surfaces scheduled to receive vinyl coated fabric wallcovering: Use MPI 45 (Interior Primer Sealer).

### 3.6 INTERIOR FINISHES

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 09 06 00, SCHEDULE FOR FINISHES.

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 two coats of MPI 147 (Institutional Low Order/VOC Interior Latex, Semi-Gloss MPI Gloss Level 5) unless specified otherwise.
  - b. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).
  - c. Ferrous Metal over 94 degrees K (200 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One coat MPI 22 (High Heat Resistant Coating (HR)).

C. Gypsum Board:

1. Typical System: Two coats of MPI 144 (Institutional Low Order/VOC Interior Latex, MPI Gloss Level 2)

### 3.7 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. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- G. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- H. Sand or dull glossy surfaces prior to painting.

- I. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

### **3.8 PAINT COLOR**

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- 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 to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
  - 1. Paint to match color of casework where casework has a paint finish.
  - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

### **3.9 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 in Section 09 06 00, SCHEDULE FOR FINISHES 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:
  - 1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
  - 2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
    - a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.



- b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
  - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
  - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
  - e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
- I. Apply paint systems on properly prepared and primed surface as follows:
- 1. Exterior Locations:
    - a. Apply two coats of MPI 9 (Exterior Alkyd Enamel (EO)) to the following ferrous metal items:
      - 1) Vent and exhaust pipes with temperatures under 94 degrees C (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
    - b. Apply two coats of MPI 10 (Exterior Latex, Flat (AE)) to the following metal items:
      - 1) Galvanized and zinc-copper alloy metal.
    - c. Apply one coat of MPI 22 (High Heat Resistant Coating (HR)), 650 degrees C (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.
  - 2. Interior Locations:
    - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
      - 1) Metal under 94 degrees C (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. Apply one coat of MPI 50 (Interior Latex Primer Sealer) and one
    - c. Paint electrical conduits containing cables rated 600 volts or more using two coats of MPI 9 (Exterior Alkyd Enamel (EO)) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.
  - 3. Other exposed locations:
    - a. 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 one coat of MPI 10 (Exterior Latex, Flat (AE)).

### 3.10 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, Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
  - 3. Painting of ferrous metal and galvanized metal.
  - 4. Identity painting and safety painting.
- B. Building and Structural Work not Painted:

1. Prefinished items:
  - a. Wood paneling, interior wood doors, linear wood ceiling, and similar items specified factory finished under other sections.
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 dumbwaiter, elevator and duct 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.

### 3.11 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 12 000 mm (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 - 414 kPa (60 psig) and above.
    - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
    - c. Low Pressure - 103 kPa (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
Boiler Feedwater		Yellow	Black	Blr Feed
Drain Line		Green	White	Drain
Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup
Hot Water Heating Return		Yellow	Black	H. W. Htg Ret
Chemical Feed		Yellow	Black	Chem Feed
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
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
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Atmospheric Vent		Green	White	ATV
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	

1. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6100 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 12,000.
2. See Sections for methods of identification, legends, and abbreviations of the following:
  - a. Conduits containing high voltage feeders over 600 volts: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

**B. Fire and Smoke Partitions:**

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE PARTITION" or, "FIRE PARTITION" as applicable.
3. Locate not more than 6100 mm (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.

**3.12 PROTECTION CLEAN UP, AND TOUCH-UP**

- 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 14 00**  
**SIGNAGE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies interior signage for room numbers, code required signs, and temporary interior signs.

**1.2 RELATED WORK**

- A. Color Finish: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 MANUFACTURER'S QUALIFICATIONS**

- A. Sign manufacturer shall provide evidence that they regularly and presently manufactures signs similar to those specified in this section as one of their principal products.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: Sign panels and frames, with letters and symbols, each type. Submit 2 sets. One set of samples will be retained by Resident Engineer, other returned to Contractor.
  - 1. Sign Panel, 200 mm x 250 mm (8 inches x 10 inches), with letters.
  - 2. Color samples of each color, 150 mm x 150 mm (6 inches x 6 inches). Show anticipated range of color and texture.
  - 3. Sample of typeface, arrow and symbols in a typical full size layout.
- C. Manufacturer's Literature:
  - 1. Showing the methods and procedures proposed for the concealed anchorage of the signage system to each surface type.
  - 2. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions.
- D. Samples: Sign location plan, showing location, type and total number of signs required.
- E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.
- F. Full size layout patterns for dimensional letters.

**1.5 DELIVERY AND STORAGE**

- A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.
- B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.
- C. Deliver signs only when the site and mounting services are ready for installation work to proceed.

- D. Store products in dry condition inside enclosed facilities.

#### **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):

B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate

B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Shapes, and tubes.

- C. Federal Specifications (Fed Spec):

MIL-PRF-8184F.....Plastic Sheet, Acrylic, Modified.

MIL-P-46144C.....Plastic Sheet, Polycarbonate

#### **1.7 MINIMUM SIGN REQUIREMENTS**

- A. Permanent Rooms and Spaces:

1. Tactile and Braille Characters, raised minimum 0.793 mm (1/32 in). Characters shall be accompanied by Grade 2 Braille.
2. Type Styles: Characters shall be uppercase, Helvetica Medium, Helvetica Medium Condensed and Helvetica Regular.
3. Character Height: Minimum 16 mm (5/8 in) high, Maximum 50 mm (2 in).
4. Symbols (Pictograms): Equivalent written description shall be placed directly below symbol, outside of symbol's background field. Border dimensions of symbol background shall be minimum 150 mm (6 in) high.
5. Finish and Contrast: Characters and background shall be eggshell, matte or other non-glare finish with adequate contrast with background.
6. Mounting Location and Height: As shown. Mounted on wall adjacent to the latch side of the door and to avoid door swing and protruding objects.

#### **1.8 COLORS AND FINISHES:**

- A. Section 09 06 00, SCHEDULE FOR FINISHES.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs complete with lettering, framing and related components for a complete installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. Resident Engineer to be notified of any discrepancy in drawing, in field

directions or conditions, and/or of any changes required for all such construction details.

- E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

## **2.2 PRODUCTS**

- A. Aluminum:
  - 1. Sheet and Plate: ASTM B209.
  - 2. Extrusions and Tubing: ASTM B221.
- B. Cast Acrylic Sheet: MIL-PRF-8184F; Type II, class 1, Water white non-glare optically clear. Matt finish water white clear acrylic shall not be acceptable.
- C. Polycarbonate: MIL-P-46144C; Type I, class 1.
- D. Vinyl: 0.1 mm thick machine cut, having a pressure sensitive adhesive and integral colors.

## **2.3 SIGN STANDARDS**

- A. Topography:
  - 1. Type Style: Helvetica Medium and Helvetica Medium Condensed. Initial caps or all caps as indicated in Sign Message Schedule.
  - 2. Arrow: See graphic standards in drawings.
  - 3. Letter spacing: See graphic standards on drawings.
  - 4. Letter spacing: See graphic standards on drawings.
  - 5. All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings are for layout purposes only; final text for signs is listed in Sign Message Schedule.
- B. Project Colors and Finishes: See Section 09 06 00, SCHEDULE FOR FINISHES.

## **2.4 SIGN TYPES**

- A. General:
  - 1. The interior sign system is comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.
    - a. IN indicates a component construction based sign.
  - 2. The exterior sign system shall be comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.
    - a. EI designation indicates exterior internally illuminated sign.
    - b. EN designation indicates exterior non-illuminated sign.
- B. Interchangeable Component System:
  - 1. Sign Type Families: 03, 04, 05, 06, 07, 08, 09 10, 11 12, 13, 14, 15, 16 and 17.

2. Interior sign system capable of being arranged in a variety of configurations with a minimum of attachments, devices and connectors.
  - a. Interchangeable nature of the system shall allow for changes of graphic components of the installed sign, without changing sign in its entirety.
  - b. Component Sign System is comprised of the following primary components:
    - 1) Rail Back utilizing horizontal rails, spaced to allow for uniform, modular sizing of sign types.
    - 2) Rail Insert mounted to back of Copy Panels to allow for attachment to Rail Back.
    - 3) Copy Panels, made of a variety of materials to allow for different graphic needs.
    - 4) End Caps which interlock to Rail Back to enclose and secure changeable Copy Panels.
    - 5) Joiners and Accent Joiners connect separate Rail Backs together.
    - 6) Top Accent Bars which provide decorative trim cap that encloses the top of sign or can connect the sign to a Type 03 Room Number Sign.
  - c. Rail Back, Rail Insert and End Caps in anodized extruded aluminum to allow for tight tolerances and consistent quality of fit and finish.
  - d. Signs in system shall be convertible in the field to allow for enlargement from one size to another in height and width through use of Joiners or Accent Joiners, which connect Rail Back panels together blindly, providing a butt joint between Copy Panels. Accent Joiners shall connect Rail Backs together with a visible 3 mm (1/8") horizontal rib, flush to the adjacent copy insert surfaces.
  - e. Sign configurations shall vary in width from 225 mm (9 inches) to 2050 mm (80 inches), and have height dimensions of 50 mm (2 inches), 75 mm (3 inches), 150 mm (6 inches), 225 mm (9 inches) and 300 mm (12 inches). Height shall be increased beyond 300 mm (12 inches), by repeating height module in full or in part.
3. Rail Back functions as internal structural member of sign using 6063T5 extruded aluminum and anodized black.
  - a. Shall accept an extruded aluminum or plastic insert on one sign or on both sides, depending upon sign type.
  - b. Shall be convertible in field to allow for connection to other Rail Back panels, so that additive changes can be made to sign unit.
  - c. Rail shall allow for a variety of mounting devices including wall mounting for screw-on applications, using pressure sensitive tape, freestanding mount, ceiling mount and other mounting devices as needed.
4. Rail Insert functions as a mounting device for Copy Panels on to the Rail Back. The Rail Insert mounts to the back of the Copy Panel with adhesive suitable for use with the particular copy insert material.
  - a. Shall allow Copy Panels to slide or snap into the horizontal Rail Back for ease of changeability.
  - b. Shall mount to the back of the Copy Panel with adhesive suitable for use with particular Copy Panel material.
5. Copy Panels shall accept various forms of copy and graphics, and attaches to the Rail Back with the Rail Insert. Copy Panels shall be either ABS plastic with integral color or an acrylic lacquer finish; photo polymer; or, acrylic.
  - a. Interchangeable by sliding horizontally from either side of sign, and to other signs in system of equal or greater width or height.
  - b. Cleanable without use of special chemicals or cleaning solutions.
  - c. Copy Insert Materials.

- 1) ABS Inserts - 2.3 mm (.090 inches) extruded ABS plastic core with .07 mm (.003 inches) acrylic cap bonded during extrusion/texturing process. Pressure bonded to extruded Rail Insert using adhesive. Background color is either integral or painted in acrylic lacquer. ABS inserts finished in a chromium industries #HM335RA texture pattern to prevent glare.
- 2) Photo polymer Inserts - 3 mm (.125 inches) phenolic photo polymer with raised copy etched to 2.3 mm (.0937 inches), bonded to an ABS plastic or extruded aluminum insert with adhesive. Background color is painted in acrylic enamel.
- 3) Changeable Paper/ Insert Holder - Extruded insert holder with integral Rail Insert for connection with structural back panel in 6063T5 aluminum with a black anodized finish. Inserts into holder are paper with a clear 0.7 mm (.030 inches) textured cover. Background color is painted in acrylic lacquer.
- 4) Acrylic - 2 mm (.080 inches) non-glare acrylic. Pressure bonded to extruded Rail Insert using adhesive. Background color is painted in acrylic lacquer or acrylic enamel.
- 5) Extruded 6063T5 aluminum with a black anodized finish Insert Holder with integral Rail Insert for connection with Structural Back Panel to hold a 0.7 mm (.030 inches) textured polycarbonate insert and a Sliding Tile which mounts in the Inset Holder and slides horizontally.
- 6) End Caps - Extruded using 6063T5 aluminum with a black anodized. End Caps interlock with Rail Back with clips to form an integral unit, enclosing and securing the changeable Copy Panels, without requiring tools for assembly.
  - a) Shall be interchangeable to either end of sign and to other signs in the system of equal height.
  - b) Mechanical fasteners can be added to the End Caps that will secure it to Rail Back to make sign tamper resistant.
- 7) Joiners - Extruded using 6063T5 aluminum with a black anodized finish. Rail Joiners connect Rail Backs together blindly, providing a butt joint between Copy Inserts.
- 8) Accent Joiners - Extruded using 6063T5 aluminum with a mirror polished finish. Joiner shall connect Rail Backs together with a visible 3 mm (.125 inches) horizontal rib, flush to the adjacent Copy Panel surfaces.
- 9) Top Accent Rail - Extruded using 6063T5 aluminum with a mirror polished finish. Rail shall provide 3 mm (.125 inches) high decorative trim cap, which butts flush to adjacent Copy Panel and encloses top of Rail Back and Copy Panel.
- 10) Typography
  - a) Vinyl First Surface Copy (non-tactile) - Applied Vinyl copy.
  - b) Subsurface Copy Inserts - Textured 1 mm (.030 inches) clear polycarbonate face with subsurface applied Vinyl copy. Face shall be back sprayed with paint and laminated to an extruded aluminum carrier insert.
  - c) Integral Tactile Copy Inserts - phenolic photo polymer etched with 2.3 mm (.0937 inches) raised copy.
  - d) Silk-screened First Surface Copy (non-tactile) - Injection molded or extruded ABS plastic or aluminum insert with first surface applied enamel silk-screened copy.

C. Sign Type Family 01, 02.01 thru 02.05, 08, 09 and 20:

1. All text and graphics are to be first surface silk-screened.
2. IN-01.1: Preparation of artwork for reproduction of "fire and emergency evacuation maps" is by manufacturer.

D. Sign Type Families 03:



1. Tactile sign is to be made from a material that provides for letters, numbers and Braille to be integral with sign plaque material such as: photosensitive polyamide resin, etched metal, sandblasted phenolic or embossed material. Do not apply letters, numbers and Braille with adhesive.
  2. Numbers, letters and Braille to be raised 0.793 mm (.0312 inches) from the background surface. The draft of the letters, numbers and Braille to be tapered, vertical and clean.
  3. Braille dots are to conform with standard dimensions for literary Braille; (a) Dot base diameter: 1.5 mm (.059 inches) (b) Inter-dot spacing: 2.3 mm (.090 inches) (c) Horizontal separation between cells: 6.0 mm (.241 inches) (d) Vertical separation between cells: 10.0 mm (.395 inches)
  4. Entire assembly is painted in specified color. After painting, apply white or other specified color to surface of the numbers and letters. Entire sign is to have a protective clear coat sealant applied.
  5. Complete sign is to have an eggshell finish (11 to 19 degree on a 60 degree glossmeter).
- E. Sign Type Family 04 and 11:
1. All text and graphics are to be first surface applied vinyl letters.
  2. IN-04: When a Type IN-04 is to be mounted under a Type IN-03, a connecting Accent Joiner is to be used to create a singular integrated sign.
- F. Sign Type Family 10:
1. Pocket depth is to be 0.3 mm (.0150 inches).
- G. Sign Type Family 12 and 13:
1. All text and graphics are to be first surface applied vinyl letters.
  2. IN-12: Provide felt, cork or similar material on bottom of desk mounting bracket to protect counter surfaces.
- H. Temporary Interior Signs:
1. Fabricated from 50 kg (110 pound) matte finished white paper cut to 100 mm (4 inch) wide by 300 mm (12 inch) long. Punched 3 mm (.125 inch) hole with edge of hole spaced 13 mm (.5 inch) in from edge and centered on 100 mm (4 inch) side. Reinforce hole on both sides with suitable material that prevents tie form pulling through hole. Ties are steel wire 0.3 mm (0.120 inch) thick attached to tag with twist leaving 150 mm (6 inch) long free ends.
  2. Mark architectural room number on sign, with broad felt marker in clearly legible numbers or letters that identify room, corridor or space as shown on floor plans.
  3. Install temporary signs to all rooms that have a room, corridor or space number. Attach to door frame, door knob or door pull.
    - a. Doors that do not require signs are: corridor doors in corridor with same number, folding doors or partitions, toilet doors, bathroom doors within and between rooms, closet doors within rooms, communicating doors in partitions between rooms with corridor entrance doors.
    - b. Replace and missing damaged or illegible signs.

## **2.5 FABRICATION**

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.

- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.
- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.
- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.
- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- K. Movable parts, including hardware, are be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.
- L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- M. No signs are to be manufactured until final sign message schedule and location review has been completed by the Resident Engineer & forwarded to contractor.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.

- B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, contact Resident Engineer for clarification.
- C. Contractor shall be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.
- D. Remove or correct signs or installation work Resident Engineer determines as unsafe or as an unsafe condition.
- E. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
- F. Locate signs as shown on the Sign Location Plans.
- G. Certain signs may be installed on glass. A blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.
- H. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
- I. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.

- - - END - - -

**SECTION 10 21 23  
CUBICLE CURTAIN TRACKS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies cubicle curtain track (C.C.T.) and curtain.

**1.2 RELATED WORK**

- A. Color and pattern of curtain: As indicated in the Section 09 06 00, SCHEDULE OF FINISHES
- B. Steel shapes to receive curtain track: Section 09 23 16, NON-STRUCTURAL METAL FRAMING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
1. One 300 mm (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. One curtain carrier.
- C. Shop Drawings: Showing layout of tracks and method of anchorage.
- D. Manufacturer's Literature and Data:
1. Cubicle curtain track.

**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. ASTM International (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. Curtain Track: Channel type as indicated on Drawings, extruded aluminum, ASTM B221, alloy 6063, temper T5 or T6, channel shaped, with smooth inside raceway for curtain 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 300 mm (one 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 CUBICAL CURTAINS**

- A. Curtain Fabric:
  - 1. Description:
    - a. Trevira FR polyester 100 percent.
    - b. Fabric to have special finish combining high performance spill and stain resistance with non-leaching antimicrobial, BioAM.
    - c. Width: 72 inches.
    - d. Weight per Linear Yard: 14.5 ounces.
    - e. Material to meet fire retardancy labeling requirements of Title 19, California Code of Regulations, Division 1, Chapter 8.
  - 2. Color and Pattern: As indicated in the Section 09 06 00, SCHEDULE OF FINISHES
- B. Grommets: Stainless steel or chrome plated brass.
- C. Curtain Tie Backs: Nickel-plated brass chain, one at each end of curtain.

**2.3 TRACK 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.

## **2.4 FINISHES**

- A. Aluminum: Finish numbers for aluminum specified are in accordance with The Aluminum Association's Designation System. AA-C22A31 finish.
- 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 CUBICAL CURTAIN TRACK 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 4800 mm (16feet) without joints. Form corner bend on a 300 mm (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.

## **2.6 CUBICLE CURTAIN FABRICATION**

- A. Fabricate curtains to comply with following requirements:
  - 1. Width: Equal to track length from which is hung plus 50 percent for added fullness, but not less than 12 inches added fullness. Standard size width when possible.
  - 2. Length: Equal to floor-to-ceiling height with 18 inch mesh top. Bottom hem to be 16 inches above finished floor.
  - 3. Top Hem: Minimal, not more than 1-1/4 inches wide.
  - 4. Mesh Top: Top hem not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/2 inch triple thickness, top hem of curtain fabric.
  - 5. Bottom Hem: 1-1/2 inches wide, double thickness and double lock stitched.
  - 6. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lock stitched.
  - 7. Vertical Seams: 1/2 inch wide, double turned and double stitched.
  - 8. Horizontal Seams: Not acceptable.
  - 9. Grommets: Space no more than 6 inches apart, machined to top hem of mesh top.]

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install curtain track recessed into ceiling as indicated on drawings.
- B. Install tracks after finish painting and ceiling finishing operations are complete.
- C. Anchor curtain tracks to ceiling framing as indicated on Drawings fasteners as indicated on Drawings.
- D. Securely fasten end stop caps to prevent their being forced out by the striking weight of carriers.
- E. 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 corner guards, edge guards, and high impact wall covering.

**1.2 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. Corner Guards
  - 2. Edge Guards
  - 3. High Impact Wall Covering
  - 4. Adhesive

**1.3 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.

**1.4 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. ASTM International (ASTM):
  - A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - 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 Series.....Metal Finishes Manual
- D. Society of American Automotive Engineers (SAE):
  - J 1545-05.....Instrumental Color Difference Measurement for Exterior Finishes



## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Stainless Steel: ASTM A167, Type 302B.
- B. Resilient Material:
  - 1. Extruded and injection molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:
    - a. Minimum impact resistance of 1197 ps (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.
- C. Adhesive: Adhesive must meet the following requirements:
  - 1. Solvent-free, water-resistant, mildew-resistant, non-flammable, low odor adhesive to suit resilient sheet floor covering and substrate conditions indicated
  - 2. Have VOC content of less than 100 g/L.
  - 3. Meet all applicable air quality requirements
  - 4. Recommended by corner and edge guard manufacturer.

### **2.2 CORNER AND EDGE GUARDS**

- A. Resilient, Shock-Absorbing Corner and Edge Guards: Flush mounted type with 6 mm (1/4-inch) corner and 58 mm (2 inch) legs
  - 1. Snap-on corner guard formed from resilient material, minimum 2 mm (0.078-inch) thick, free floating on a continuous 1.6 mm (0.063-inch) thick extruded aluminum retainer. Design retainer used for flush mounted type to act as a stop for adjacent wall finish material. 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.
- B. Stainless Steel Corner and Edge Guards: Fabricate of 1.6 mm (0.0625-inch) thick stainless steel. Form guards of dimensions and to contour shown.

### **2.3 HIGH IMPACT WALL COVERING**

- A. Fabricate from vinyl acrylic or polyvinyl chloride resilient material minimum 6 mm (0.06 inch) thick designed specially for interior use.
- B. Provide adhesive as recommended by the wall covering manufacturer.

### **2.4 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Stainless Steel: NAAMM finish Number 4.

- C. Resilient Material: Embossed texture and color in accordance with SAE J 1545 and as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

### **PART 3 - INSTALLATION**

#### **3.1 STAINLESS STEEL CORNER AND EDGE GUARDS**

- A. Mount guards on external corners of interior walls, partitions and columns where indicated on Drawings.
- B. Apply cement to back of guard and firmly set in place; remove excess cement.
- C. No exposed fasteners will be permitted.

#### **3.2 HIGH IMPACT WALL COVERING**

- A. Surfaces to receive protection shall be clean, smooth and free of obstructions.
- B. Apply with adhesive in controlled environment according to manufacture's recommendations.

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**SECTION 10 28 00  
TOILET ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies manufactured items usually used in rooms, toilets rooms, locker rooms and at sinks in related spaces.
- B. Items Specified:
  - 1. Sanitary napkin disposals.
- C. The Government will furnish and Contractor will install Soap Dispensers.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each product specified.
  - 2. Grab bars, showing design and each different type of anchorage.
  - 3. 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.

**1.3 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.

**1.4 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.

#### 1.5 STORAGE

- A. Store products in weather tight 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.

#### 1.6 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. ASTM International (ASTM):
  - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
  - A269-10.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - B456-03.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
  - C1036-06.....Flat Glass
  - F446-85 (R2004).....Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series.....Metal Finishes Manual
  - AMP 500-505-88.....Metal Finishes Manual and Finishes for Stainless Steel
- D. Federal Specifications (Fed. Specs.):
  - FF-S-107C (2).....Screw, Tapping and Drive
  - WW-P-541E(1).....Plumbing Fixtures (Accessories, Land Use) Detail Specification

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Manufacturers standard basis material for specified product unless otherwise indicated.
- 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. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.
- D. Glass:
  - 1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors.

### **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.

### **2.3 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum:
  - 1. AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
- C. Exposed Surface Finish:
  - 1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
  - 2. Stainless Steel: NAAMM AMP 503, finish number 4.
  - 3. Ferrous Metal:
    - a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
    - b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.

### **2.4 FABRICATION - GENERAL**

- A. Grind dress, and finish welded joints to match finish of adjacent surface.

- B. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.
- C. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- D. Key items alike.
- E. Provide templates and rough-in measurements as required.
- F. Round and deburr edges of sheets to remove sharp edges.

## **2.5 SANITARY NAPKIN DISPOSAL**

- A. Partition-mounted; self-closing panel to cover each disposal opening. Napkin disposal to be emptied by opening door on one side of unit. Constructed from stainless steel, type 304, satin finish. Flanges are one piece seamless. Doors to have full length stainless steel piano hinges and equipped with tumbler lock.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Before starting work notify Contracting Officer's Technical Representative in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the Contracting Officer's Technical Representative 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.
- 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. Install accessories to prevent striking by other moving, items or interference with accessibility.

**3.3 CLEANING**

- A. After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

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**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.
- B. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:
  - 1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; and storage racks.
  - 2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems.
  - 3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler equipment and components.
  - 4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

**1.2 RELATED WORK:**

- A. N/A
- B. Procedures and requirements for managing and disposing construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- D. Division 22 - Plumbing
- E. Division 23 - heating, Ventilating, and Air Conditioning (HVAC)
- F. Division 26 - Electrical

**1.3 QUALITY CONTROL:**

- A. Shop-Drawing Preparation:
  - 1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the state where the project is located.



2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State where project is located.

B. Coordination:

1. Do not install seismic restraints until seismic restraint submittals are approved by the Contracting Officer's Representative.
2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

C. Seismic Certification:

In structures assigned to IBC Seismic Design Category C, D, E, or F, permanent equipment and components are to have Special Seismic Certification in accordance with requirements of section 13.2.2 of ASCE 7 except for equipment that are considered rugged as listed in section 2.2 OSHPD code application notice CAN No. 2-1708A.5, and shall comply with section 13.2.6 of ASCE 7.

D. Support and Seismic Restraint Criteria:

1. All piping, ductwork, and equipment supports and bracings shall be designed and calculated in accordance with ASCE 7 Chapter 13 requirements for critical facilities seismic occupancy category IV with components importance factor of  $I_p = 1.5$ . The site spectral response accelerations are as follow:
  - a.  $S_s = 1.959$
  - b.  $S_1 = 0.827$
  - c. Seismicity = very high
2. All equipment that require seismic certification as indicated in other section should be supported and braced in accordance with the methods approved in the certification process.

**1.4 SUBMITTALS:**

- A. Submit a coordinated set of equipment anchorage drawings prior to installation including:
  1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
  2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
  3. Numerical value of design seismic brace loads.
  4. For expansion bolts, include design load and capacity if different from those specified.
- B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:
  1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
  2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
  3. Pipe contents.
  4. Structural framing.
  5. Location of all gravity load pipe supports and spacing requirements.
  6. Numerical value of gravity load reactions.
  7. Location of all seismic bracing.

8. Numerical value of applied seismic brace loads.
  9. Type of connection (Vertical support, vertical support with seismic brace etc.).
  10. Seismic brace reaction type (tension or compression): Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.
- C. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:
1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
  2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
  3. Maximum spacing of hangers and bracing.
  4. Seal of registered structural engineer responsible for design.
- D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.
- E. Submit for concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

#### 1.5 APPLICABLE PUBLICATIONS:

- A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
- 355.2-07.....Qualification for Post-Installed Mechanical Anchors in Concrete and Commentary
- C. American Institute of Steel Construction (AISC):
- Load and Resistance Factor Design, Volume 1, Second Edition
- D. American Society for Testing and Materials (ASTM):
- A36/A36M-08.....Standard Specification for Carbon Structural Steel
- A53/A53M-10.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- A307-10.....Standard Specification for Carbon Steel Bolts and Studs; 60,000 PSI Tensile Strength.
- A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- A325M-09.....Standard Specification for High-Strength Bolts for Structural Steel Joints [Metric]

- A490-10.....Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
- A490M-10.....Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]
- A500/A500M-10.....Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- A501-07.....Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- A615/A615M-09.....Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- A992/A992M-06.....Standard Specification for Steel for Structural Shapes for Use in Building Framing
- A996/A996M-09.....Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
- E488-96(R2003).....Standard Test Method for Strength of Anchors in Concrete and Masonry Element
- E. American Society of Civil Engineers (ASCE 7) Latest Edition.
- F. International Building Code (IBC) Latest Edition
- G. VA Seismic Design Requirements, H-18-8, February 2011
- H. National Uniform Seismic Installation Guidelines (NUSIG)
- I. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA): Seismic Restraint Manual - Guidelines for Mechanical Systems, 1998 Edition and Addendum

#### 1.6 REGULATORY REQUIREMENT:

- A. IBC 2009.
- B. Exceptions: The seismic restraint of the following items may be omitted:
  1. Equipment weighing less than 400 pounds, which is supported directly on the floor or roof.
  2. Equipment weighing less than 20 pounds, which is suspended from the roof or floor or hung from a wall.
  3. Gas and medical piping less than 2 ½ inches inside diameter.
  4. Piping in boiler plants and equipment rooms less than 1 ¼ inches inside diameter.
  5. All other piping less than 2 ½ inches inside diameter, except for automatic fire suppression systems.
  6. All piping suspended by individual hangers, 12 inches or less in length from the top of pipe to the bottom of the support for the hanger.
  7. All electrical conduits, less than 2 ½ inches inside diameter.

8. All rectangular air handling ducts less than six square feet in cross sectional area.
9. All round air handling ducts less than 28 inches in diameter.
10. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of support for the hanger.

## **PART 2 - PRODUCTS**

### **2.1 STEEL:**

- A. Structural Steel: ASTM A36.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53/A53M, Grade B.
- E. Bolts & Nuts: ASTM A307.

### **2.2 CAST-IN-PLACE CONCRETE:**

- A. Concrete: 28 day strength,  $f'c = 25 \text{ MPa}$  (3,000 psi)
- B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION, GENERAL:**

- A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.
- B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- C. Construct seismic restraints and anchorage to allow for thermal expansion.
- D. Testing Before Final Inspection:
  1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
  2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

### **3.2 EQUIPMENT RESTRAINT AND BRACING:**

- A. See drawings for equipment to be restrained or braced.

**3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS**

- A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).
- B. Brace duct and breeching branches with a minimum of 1 brace per branch.
- C. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.
- D. Seismic Restraint of Piping:
  - 1. Design criteria:
    - a. Piping resiliently supported: Restrain to support 120-percent of the weight of the systems and components and contents.
    - b. Piping not resiliently supported: Restrain to support 60-percent of the weight of the system components and contents.
  - 2. Provide seismic restraints according to one of the following options:
    - a. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

**3.4 PARTITIONS**

- A. In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.
- B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

**3.5 CEILINGS AND LIGHTING FIXTURES**

- A. At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.
- B. Independently support and laterally brace all lighting fixtures. Refer to applicable portion of lighting specification, Section 26 51 00, INTERIOR LIGHTING.

**3.6 FACADES AND GLAZING**

- A. Do not install concrete masonry unit filler walls in a manner that can restrain the lateral deflection of the building frame. Provide a gap with adequately sized resilient filler to separate the structural frame from the non-structural filler wall.

- B. Tie brick veneers to a separate wall that is independent of the steel frame as shown on construction drawings to ensure strength against applicable seismic forces at the project location.
- C. Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

**3.7 STORAGE RACKS, CABINETS, AND BOOKCASES**

- A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.
- B. Anchor medical supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.
- C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.
- D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

**3.8 CONSTRUCTION WASTE MANAGEMENT**

- A. General: Comply with Contractor's Waste Management Plan and Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

- - - 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.
- D. Section 07 84 00, FIRESTOPPING.
- E. Section 09 91 00, PAINTING.
- F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS
- G. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

**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 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.
- G. Plumbing products shall comply with BAA, Buy American Act.
- H. Vibration isolation of plumbing equipment.

#### **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.
  - 6. Vibration isolation supports and pads.
- 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, or ceilings.

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 Contracting Officers Technical Representative (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
- C. International Code Council, (ICC):
  - IBC-09, (R 2009).....International Building Code
  - IPC-09, (R 2009).....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. 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, "inverter 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. 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.
- D. 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.
- B. Piping penetrations through rated and non-rated walls shall be fire stopped with UL Listed assemblies for the type of construction.

## 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 COTR 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.
- F. 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.
- G. 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.

H. 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.
- i. Spring hangers are required on all plumbing system pumps one horsepower and greater.

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.

I. Pre-insulated Calcium Silicate Shields:

- 1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
- 2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
- 3. Shield thickness shall match the pipe insulation.
- 4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
  - a. Shields for supporting cold water shall have insulation that extends a minimum of one inch past the sheet metal.
  - b. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields shall have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural



steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

J. Seismic Restraint of Piping: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

## **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 COTR.
- 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 COTR.
- 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.

## **2.15 VIBRATION AND ISOLATION**

- A. Ductile iron housing mount with captive neoprene elements arranged in opposition to provide a positive restraint in all directions, no metal contact during normal operation, and bolt for equipment attachment. All mountings shall have a min. 1.0 G rating. Rated static deflection shall be min. 5 mm (0.2 inch).
- B. Neoprene pad, 19 mm (0.75 inch) thick, with steel plate and 19 mm (0.75 inch) center hole for bolting through to floor. Deflection under load shall be in range of 6.6% to 10% of normal thickness.

## **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 COTR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to 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 COTR. Damaged or defective items in the opinion of the COTR, 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 bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.
  - N. 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.
  - 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 electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.
  - P. Vibration and Isolation:
    - 1. Provide Type BR isolation mounting assembly under all support points of equipment with motors.
    - 2. Provide neoprene isolation pads between tank support connections and concrete floor. Provide resilient grommets to isolation bolt and isolation pad steel plate.

### **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 COTR.
- 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 vibration isolation, refer to paragraph 3.1.P above.
  - 5. 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 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 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. Prior to demolishing plumbing piping systems over corridors, coordinate with the Hospital for shut down and time required for all work in the corridor. Coordinate with General Requirements regarding screening the corridor during construction.
- D. 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.
- E. 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 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.
- F. Asbestos Insulation Removal: Conform to Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

### 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 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.

VAMC Palo Alto, CA

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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, Reverse Osmosis, and Dialysis acid and bicarbonate solutions.

**1.2 RELATED WORK**

- A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- B. Section 22 67 19.21, DIALYSIS EQUIPMENT.

**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. Check valves.
  - 3. Pressure reducing valves.
  - 4. Backflow Preventers.
  - 5. Mixing valves.
  - 6. Backflow Preventers.

**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 1013-05.....Reduced Pressure 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 UnionsSP-67-02a (R 2004) Butterfly  
Valve of the Single flange Type (Lug Wafer)

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 shall be lead-free. 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 lead-free, 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.

2. Reverse Osmosis Water:

- a. 25 mm (1 inch) and smaller: Type 316 stainless steel construction ball valve with tube fitting end connections, PTFE seats, 316 stainless steel ball, lever handle, and 15,168 kPa (2200 PSIG) rated.

3. Dialysis Acid and bicarbonate Solutions:

- a. 25 mm (1 inch) and smaller: Type 316 stainless steel construction ball valve with factory installed 316L stainless steel 76 mm (3-inch) long tubing extensions, lever handle, and 15,168 kPa (2200 PSIG) rated.

4. Utility Box Supply Connections:

- a. 316 Stainless steel construction, straight pattern needle valve with tubing fitting ends, screwed-bonnet, PTFE coated stem, PTFE packing, 4,137 kPa (600 PSIG) rated. Provide adaptor to connect valve to polyethylene tubing.

G. Check:

- 1. Check valves less than 80 mm or DN80 (3 inches) and smaller) shall be PVC body with EPDM seals.

**2.2 BACKFLOW PREVENTERS**

- A. A reduced pressure backflow preventer shall be installed in the following applications.

- 1. Dialysis, Deionized or Reverse Osmosis Water Systems.

- B. See Section 223111 WATER SOFTENER AND FILTERS for specification.

**2.3 MIXING VALVES**

- A. Thermostatic mixing valve shall be ASSE 1017 Listed, lead-free, bronze construction, bimetal thermostat, integral combination check stops, adjustable high temperature stop for 43 degrees C (110 deg F), 860 kPa (125 PSIG) rated, and chrome plate finish.

- B. Mixing valve assembly shall be factory assembled, complete with discharge water dial temperature -10 Deg to 60 Deg C (0 - 140 deg F), and main bronze ball valve shutoff valve. Assembly shall be chrome plate finish. Set mixing valve at 24.4 deg C (76 deg F).

- C. Mixing Valve shall have 19 mm (3/4 inch) hot and cold water inlets, and 25 mm (1 inch) discharge, and capable of 0.63 LPS (10 GPM) max flow rate.

**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.
- G. Backflow Preventer shall be provided on make-up water for dialysis processing equipment before the reverse osmosis unit.

### **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.

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**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.
- 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, and pipe spaces.
  - 5. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, 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:  $\text{kg/m}^3$  - 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 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
- B. 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.

C. GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.

D. 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. Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-90.....Adhesives, Fire-Resistant, Thermal Insulation

MIL-C-19565C (1)-88.....Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
- D. American Society for Testing and Materials (ASTM):

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
- C547-07 .....Standard Specification for Mineral Fiber pipe  
Insulation
- 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
- C1136-10 .....Standard Specification for Flexible, Low  
Permeance Vapor Retarders for Thermal  
Insulation
- 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
- E136-09 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):
- 101-09 .....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 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 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 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 <sup>3</sup> (lb/ ft <sup>3</sup> )	232 (14.5)	288 (18)
Thermal conductivity: Min W/ m K (Btu in/h ft <sup>2</sup> 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

## 2.4 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 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. 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.

## 2.5 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/m<sup>3</sup> (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/m<sup>3</sup> (3.0 pcf).

## 2.6 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.

## **2.7 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.

## **2.8 FIRESTOPPING MATERIAL**

Other than pipe insulation, refer to Section 07 84 00 FIRESTOPPING.

## **2.9 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 Contracting Officers Technical Representative (COTR) 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. Plumbing work not to be insulated:
  - 1. Piping and valves of fire protection system.
  - 2. Chromium plated brass piping.
  - 3. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).
  - 4. RO (Reverse Osmosis) Water piping.
  - 5. Dialysis acid and bicarbonate piping systems.
- 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. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.
- K. 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

### 3.2 INSULATION INSTALLATION

- A. 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.
- B. 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	Thru 25	32 to 75	100-200	Over 200
Millimeters (Inches)	(1)	(1-1/4 to 3)	(4 to 6)	(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)

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**SECTION 22 08 00  
COMMISSIONING OF PLUMBING SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 22.
- B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the Department of Veterans Affairs will manage the commissioning process.

**1.2 RELATED WORK**

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

**1.3 SUMMARY**

- A. This Section includes requirements for commissioning plumbing systems, dialysis systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.
- C. The commissioning activities have been developed to support the United States Green Building Council (USGBC) LEED™ rating program and to support delivery of project performance in accordance with the Contract Documents developed with the approval of the VA.
  - 1. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" prerequisite of "Fundamental Building Systems Commissioning".
  - 2. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" requirements for the "Enhanced Building System Commissioning" credit.
  - 3. Activities and documentation for the LEED™ section on "Measurement and Verification" requirements for the Measurement and Verification credit.
- D. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more specifics regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

#### **1.4 DEFINITIONS**

- A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

#### **1.5 COMMISSIONED SYSTEMS**

- A. Commissioning of a system or systems specified in this Division is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.
- B. The following Plumbing systems will be commissioned:
  - 1. Domestic Water Filtration and Softener Systems (Tanks and casings, gages and instruments, controls, pumps and motors - if applicable, packaged piping, alarms).
  - 2. Process Water Systems (Controls, piping, tanks and casings, gages and instruments, pumps, motors, and Variable Speed Drives - if applicable for reverse osmosis (RO) and deionized water (DI) systems).
  - 3. Dialysis acid systems (packaged pipes and fittings, tanks, pumps, pressure gages, motors, instrumentation, and alarms).

#### **1.6 SUBMITTALS**

- A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.
- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 PRE-FUNCTIONAL CHECKLISTS**

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the

Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

### **3.2 CONTRACTORS TESTS**

- A. Contractor tests as required by other sections of Division 22 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

### **3.3 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:**

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

### **3.4 TRAINING OF VA PERSONNEL**

- A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 22 Sections for additional Contractor training requirements.

----- END -----

**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: Penetrations in rated enclosures
- B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.
- C. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- E. Section 22 07 11, PLUMBING 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)
  - A13.1-2007.....Scheme for Identification of Piping Systems
  - B16.12-2009 .....Cast Iron Threaded Drainage Fittings ANSI/ASME
  - B16.18-01 (R2005).....Cast Copper Alloy Solder-Joint Pressure Fittings ANSI/ASME
  - B16.22-01 (R2005).....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings ANSI/ASME Element ANSI/ASME

NSF/ANSI 61.....Drinking Water System Components - Health  
Effects

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

A47/A47M-99(2009).....Ferritic Malleable Iron Castings Revision 1989

A183-03(2009).....Carbon Steel Track Bolts and Nuts

A269-10.....Standard Specification for Seamless and Welded  
Austenitic Stainless Steel Tubing for General  
Service

A312/A312M-09.....Seamless, Welded, and Heavily Cold Worked  
Austenitic Stainless Steel Pipes

A403/A403M-10a.....Standard Specification for Wrought Austenitic  
Stainless Steel Piping Fittings

A733-03(2009).....Welded and Seamless Carbon Steel and Austenitic  
Stainless Steel Pipe Nipples

B32-08.....Solder Metal

B61-08.....Steam or Bronze Castings

B88-09.....Seamless Copper Water Tube

B300-10.....AWWA Standard for Hypochlorites

B301-10.....AWWA Standard for Liquid Chlorine

B584-09a.....Copper Alloy Sand Castings for General  
Applications Revision A

B687-99(2005) e1.....Brass, Copper, and Chromium-Plated Pipe Nipples

D1785-06.....Standard Specification for Poly (Vinyl  
Chloride) (PVC) Plastic Pipe, Schedules 40, 80,  
and 120

D4101-09.....Propylene Plastic Injection and Extrusion  
Materials

D2447-03.....Polyethylene (PE) Plastic Pipe, Schedule 40 and  
80, Based on Outside Diameter

D2564-04(2009) e1.....Solvent Cements for Poly (Vinyl Chloride) (PVC)  
Plastic Pipe and Fittings

D4101-09.....Propylene Plastic Injection and Extrusion  
Materials

E1120-08.....Standard Specification For Liquid Chlorine

E1229-08.....Standard Specification For Calcium Hypochlorite

D. American Water Works Association (AWWA):

C651-05.....Disinfecting Water Mains

E. American Welding Society (AWS):

A5.8/A5.8M:2004.....Filler Metals for Brazing

F. International Plumbing Code

International Plumbing Code - 2009

G. American Society of Sanitary Engineers (ASSE):

ANSI/ASSE (Plumbing)

1001-2008.....Pipe Applied Atmospheric Type Vacuum Breakers

ANSI/ASSE 1010-2004.....Water Hammer Arresters

ANSI/ASSE 1018-2001.....Performance for trap seal primer valves -  
potable water supplied.

ANSI/ASSE (Plumbing)

1020-2004.....Pressure Vacuum Breaker Assembly

H. Association for the Advancement of Medical Instrumentation (AAMI)

ANSI/AAMI RD62:2001 (Dialysis water quality)

I. Plumbing and Drainage Institute (PDI):

PDI WH-201 2007.....Water Hammer Arrestor

**1.5 QUALITY ASSURANCE**

- A. For mechanical pressed sealed fittings, only tools of fitting manufacture shall be used.
- 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.

**PART 2 - PRODUCTS**

**2.1 ABOVE GROUND (INTERIOR) WATER PIPING**

- A. Hot and Cold Water Pipe: Copper tube, ASTM B88, Type K or L, drawn.
- 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 lead-free solder for all soldered joints.
- C. Fittings for Stainless Steel:
  - 1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ANSI B16.9.

2. Stainless steel construction, two-ferrule mechanical grip design unions, and connectors.

D. Adapters: Provide adapters for joining screwed pipe to copper tubing.

E. Solder: ASTM B32 Composition B32-08, classification HB. Provide non-corrosive flux.

F. Reverse Osmosis Distribution Piping:

1. ASTM 312, Schedule 10S IPS, annealed type 316L, welded seamless austenitic stainless steel piping, with ASTM 403, type 316L wrought austenitic stainless steel short radius fitting.

<u>Tubing sizes (inches)</u>	<u>Wall Thickness (inches)</u>
1/2	0.049
3/4	0.065
1	0.083

G. Dialysis Acids and Bicarbonate Piping:

1. Stainless steel tubing, type 316L, polished ID and OD tubing comply with ASTM269, factory prepared ends for orbital welding, rinsed with 18 mega-ohm deionized water, purged with nitrogen, and factory packaged and sealed. Factory cleaned and sealed in an ISO Class 4/Federal Classroom 10 cleanroom. Fittings shall be stainless steel and for orbital welding conform with ASME B31.1 and ASME 31.3. The pipe and fittings shall transport 10 megohm water with no loss of purity.
2. Polyethylene tubing, food and medical grade, capable of transporting 10 megohm water with no loss of purity. Processed by continuous compression molding without the addition of fillers, polymer modifiers or processing aids. Uniform color with no cracks, flaws, blisters or other imperfections in appearance. In accordance with manufacturer's recommendations, provide continuous channel support under all horizontal piping.
3. Reverse Osmosis and Dialysis Piping in Water Treatment Room:
  - a. Low Pressure Feed, Reject and Recycle Piping (75 psi and under): ASTM D 1785, Schedule 80 PVC, socket welded and flanged.
  - b. RO Product Tubing From Each Membrane Housing: ASTM D1785, Schedule 80 PVC, socket welded and flanged.
  - c. Low Pressure Control and Pressure Gage Tubing: Polyethylene.
  - d. High Pressure Reject and Recycle Piping (above 75 psi): ASTM A269, Type 304 schedule 10 stainless steel with butt welded joints.
  - e. High Pressure Control and Pressure Gage Tubing: 1000 psi burst nylon.

## 2.2 EXPOSED WATER PIPING

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, and equipment 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, (125 and 250).
3. Nipples: ASTM B 687, Chromium-plated.
4. Unions: MSS SP-72, SP-110, Brass or Bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

- B. Unfinished Rooms, Mechanical Rooms: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

### **2.3 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 B32-08 classification HB. Provide non-corrosive flux.

### **2.4 DIELECTRIC FITTINGS**

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

### **2.5 STERILIZATION CHEMICALS**

- A. Hypochlorites ANSI/AWWA B300-10
- B. Liquid Chlorine ANSI/AWWA B301-10

### **2.6 WATER HAMMER ARRESTER:**

- A. Closed copper tube chamber with permanently sealed 410 kPa (60 psig) 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, Chapter No. 3.
  - b. Plastic piping shall be supported with "V" channel between hangers.
  - c. 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.
  - d. Floor, Wall and Ceiling Plates, Supports, Hangers:
    - 1) Solid or split unplated 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, FIRESTOPPING. 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, JOINT SEALANTS.

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.
  - c. Coordinate locations of water hammer arresters with access panel locations.
2. Dialysis piping systems and Reverse Osmosis piping system shall comply with ANSI/AAMI RD62:2001 requirements.
  - a. Plastic tubing in wall spaces at dialysis boxes shall be provided with excess tubing to allow removal of dialysis box.

### 3.2 TESTS

- A. General: Test system either in its entirety or in sections.
- B. Potable Water System: Test after installation of piping, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 690 kPa (100 psi) 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. Reverse Osmosis Water and Dialysis Solution Piping Systems: Fill system with high purity bacteria and pyrogen-free water and maintain hydrostatic pressure of 690 kPa (100 psi) gage during inspection and prove tight. Tap water is not acceptable.
  1. Each piping system shall be sanitized with bleach by filling the piping system with 1:100 ppm solution and allow the system to circulate with the solution for 2 hours. Each system shall be rinsed with high purity water until the system tests to 0 ppm chlorine.
  2. After testing, each system shall be emptied and air-dried with 0.22 micron filtered air, and it must not be allowed to remain with standing water.
  3. Re-test and re-sanitize if any part of the piping system has repair or new connection work performed.

### 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 hypochlorites for sterilization.

### 3.4 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.

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**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 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.
- E. Section 22 67 19.21, DIALYSIS EQUIPMENT.
- F. 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. Floor Sinks.
  - 4. Cleanouts.
  - 5. Trap Primers.
  - 6. 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
  - B16.12-98 (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):

A74-06.....Standard Specification for Cast Iron Soil Pipe  
and Fittings

A183-03.....Standard Specification for Carbon Steel Track  
Bolts and Nuts

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

D. International Code Council:

IPC-09.....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 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.
4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310.

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.

## **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 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 rating 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 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.
- B. 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.
- C. 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.
- D. 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, 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 shall have an acid resisting, enamel finish.

## 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-1): The trap seal primer system shall be electronic type conforming to ASSE 1044.
  - 1. The controller shall have a 24 hour programmable timer, solid state, 6 outlet zones, minimum adjustable run time of 1 minute for each zone, 12 hour program battery backup, manual switch for 120VAC power, 120VAC to 24VAC internal transformer, fuse protected circuitry, UL listed, 120VAC input-24VAC output, constructed of enameled steel or plastic.



2. The cabinet shall be recessed mounting with a stainless steel cover.
  3. The solenoid valve shall have a brass body, Buna "N" seats, normally closed, 5.98 kPa (125 psi) rated, 24VAC.
  4. The control wiring shall be copper in accordance with the latest edition of the National Electric Code, Article 725 and not less than 18 gauge. All wiring shall be in conduit and in accordance with Division 26 of the specifications.
  5. The vacuum breaker shall conform to ASSE 1001.
- B. 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.

## **2.8 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.
- 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.

### **3.2 JOINT CONSTRUCTION**

- A. 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.
- B. 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.
- C. 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.

### **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, Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL

COMPONENTS, 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. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).
- F. 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.
- G. 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.
- H. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- I. 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.

J. 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.

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 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.
- 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-08 .....Enameled 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):
  - A276-2010 .....Stainless and Heat-Resisting Steel Bars and Shapes

WW-P-541-E/GEN .....Plumbing 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):

61-2009 .....Drinking 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. Locate stops centrally above or below fixture in accessible location.
- B. Furnish keys for lock shield stops to COTR.
- 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 31.5 ml/s (0.5 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.
  - 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.

**2.6 WATER CLOSETS**

- A. (P-103) Water Closet (Wall Hung, ASME/ANSI A112.19.2M, Figure 9) office and industrial, elongated bowl, siphon jet 4.8 L (1.28 gallons) per flush, wall outlet. Top of rim shall be between 406 mm and 432 mm (16 inches and 17 inches) above finished floor. Handicapped water closet shall have rim set 457 mm (18 inches) above finished floor.
  - 1. Seat: Institutional/Industrial, extra heavy duty, chemical resistant, solid plastic, open front less cover for elongated bowls, integrally molded bumpers, concealed check hinge with stainless steel post. Seat shall be posture contoured body design. Color shall be white.
  - 2. Fittings and Accessories: Gaskets - neoprene; bolts with chromium plated caps nuts and washers.
  - 3. Flush valve: Large chloramines resistant diaphragm, semi-red brass valve body, exposed chrome plated, sensor operated with manual override, water saver design 4.8 L (1.28 gallons) per flush with

maximum 10 percent variance, 25 mm (1 inch) screwdriver back check angle stop with vandal resistant cap, adjustable tailpiece, a high back pressure vacuum breaker, spud coupling for 38 mm (1 1/2 inches) top spud, wall and spud flanges, and sweat solder adapter with cover tube and set screw wall flange. Provide 120V - single phase transformer for water closet and adjacent lavatory. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM alloy classification for semi-red brass. Seat bumpers shall be integral part of flush valve. Set centerline of inlet 292 mm (11 1/2 inches) above rim.

## 2.7 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. (P-404) Lavatory (Integral with Countertop):
  - 1. Specified under architectural section of work.
  - 2. Faucet: Solid cast brass construction, chrome plated, faucet with dual beam infrared electronic sensor, and swing/rigid gooseneck spout 197 mm (7-3/4 inches) above the rim, sensor lens shall be scratch resistant heavy duty polycarbonite, single hole mounting, hardwire Class 2A transformer with standard 4-inch mounting plate for 120VAC input by 12VAC output with 300mA current, single supply for tempered water inlet, brass body thermostatic mixing valve underneath fixture with 9.5 mm (3/8 inch) compression inlets and outlet, and integral inlet check valves. Provide 0.095 LPS (1.5 GPM) laminar flow control device inserted in inlet to spout. All connecting wiring between transformer, solenoid valve and sensor shall be cut to length with no excess hanging or wrapped up wiring allowed. Locate transformer behind access panel on wall below fixture. Set mixing valve temperature at 38 deg C (100 deg F).
  - 3. Drain: Cast or wrought brass with flat grid strainer and offset tailpiece, chrome plated finish.
  - 4. Stops: Angle type. See paragraph 2.2 Stops.
  - 5. 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 1.4 mm thick (17 gauge) 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.
  - 6. Provide cover for drain, stops and trap per A.D.A 4-19.4.
- D. (P-418) Lavatory (Sensor Control, Gooseneck Spout, ASME/ANSI A112.19.2M, Figure 16) straight back, approximately 540 mm by 559 mm (21-1/4 inches by 22 inches), 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, faucet with dual beam infrared electronic sensor, and swing/rigid gooseneck spout 197 mm (7-3/4 inches) above the rim, sensor lens shall be scratch resistant heavy duty polycarbonite, single hole mounting, hardwire Class 2A transformer with standard 4-inch mounting plate for 120VAC input by 12VAC output with 300mA current, single supply for tempered water inlet, brass body thermostatic mixing valve



- underneath fixture with 9.5 mm (3/8 inch) compression inlets and outlet, and integral inlet check valves. Provide 0.095 LPS (1.5 GPM) laminar flow control device inserted in inlet to spout. All connecting wiring between transformer, solenoid valve and sensor shall be cut to length with no excess hanging or wrapped up wiring allowed. Locate transformer behind access panel on wall below fixture. Set mixing valve temperature at 38 deg C (100 deg F). install mixing valve and transformer in wall space below lavatory, and provide 10" x 10" stainless steel access panel.
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 vitreous china shroud 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 floors. 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 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 22 67 19.16  
REVERSE-OSMOSIS WATER EQUIPMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Provide complete medical packaged reverse osmosis (RO) water treatment system designed for dialysis water treatment applications. Designed for continuous automatic operation. The system shall include pre-filter, product storage tank and all devices necessary for fully operational system. RO system operation will be controlled by the water level in the product storage tank. Water quality shall comply with AAMI requirements.

**1.2 RELATED WORK**

- A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- B. Systems for service other than boiler plant make-up water, 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.
- F. Section 22 11 00, FACILITY WATER DISTRIBUTION.
- H. Section 22 67 19.21, DIALYSIS EQUIPMENT.

**1.3 QUALITY ASSURANCE**

- A. Selected manufacturer will have facilities that are QSR/GMP compliant and FDA- and ISO-9001 registered. In addition, they will have received FDA 510(k) clearance to produce water system components that are Class II medical devices.
- B. All equipment and components will be manufactured from new unused materials that are free from defects.

**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. Catalog cuts, complete description and specifications of all equipment and accessories.
  - 2. Reverse Osmosis Unit.
  - 3. Filter housing assembly and cartridges.
  - 4. Product storage tank.
  - 5. Pressure gauges.
  - 6. Circulating pump and control.
  - 7. Ultra-violet sterilizer.
  - 8. Test Kit.
  - 9. Performance data including normal and maximum flow and pressure drop. Certification that required performance will be achieved.

10. Piping and fittings.

- C. Complete detailed layout, setting, arrangement, and installation drawings including. Drawings shall also show all parts of the apparatus including relative positions, dimensions, and sizes and general arrangement of connecting piping.
- D. 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.
- E. Provide seismic restraint design and shop drawings per Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**1.5 PROJECT CONDITIONS**

A. Influent Water Analysis:

Maximum Silt Density Index (SDI) Rating	TBD
Turbidity, NTU	5
Maximum Free Chlorine and/or Chloramine	4 ppm
Color:	15 SMCL
Maximum pH (continuous)	8.7
Minimum pH (continuous)	8.2
Maximum pH (cleaning-30 minutes)	TBD
Minimum pH (cleaning-30 minutes)	TBD
Confirm the analysis with current samples and tests.	

B. Design Parameters:

Normal System Flow: 0.06 L/s (1 gpm)

Maximum System Flow: 0.32 L/s (5 gpm)

Daily Water Usage: 79.5 liters per day (21 gallons per day)

Daily Hours of Water Demand: 8

Operating Temperature Range: 24 - 25 degrees C (75 - 77 degrees F)

**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. Association for the Advancement of Medical Instrument: AAMI
- C. American Society of Mechanical Engineers (ASME):  
B40.100-2005.....Pressure Gages and Gage Attachments

D. ASTM International (ASTM):

A269-07.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service.

D1785-06.....Poly (Vinyl Chloride) (PVC) Plastic Pipe,  
Schedules 40, 80, and 120.

E. American Water Works Association (AWWA):

B300-04.....Hypochlorites

B301-04.....Liquid Chlorine

C651-05.....Disinfecting Water Mains

F. National Electrical Manufacturers Association (NEMA):

ICS-6-1993(R2001, R2006).....Industrial Control and Systems:  
Enclosures

G. National Fire Protection Association (NFPA):

70- 08 .....National Electrical Code.

H. Department of Health and Human Services, Food and Drug Administration  
(FDA):

CFR 21, Chapter 1, Part 175.300, 02 Resinous and Polymeric Coatings

**PART 2 - PRODUCTS**

**2.1 REVERSE OSMOSIS SYSTEM**

A. Piping and Fitting: See SECTION 22 11 00 FACILITY WATER DISTRIBUTION.

B. Reverse Osmosis System shall be medical system designed for dialysis water treatment applications, 510(k) file number K013677. System shall be manufactured in a QSR/ISO 9001, ISO 13485 compliant registered facility. RO hemodialysis make-up flow and storage tank will produce and store adequate water quantity to operate a twelve (12) patient station clinic, (2) shifts per day without interruption. Packaged automatic reverse osmosis system shall be mounted on steel frame, and comply with Seismic Design Category F. Unit shall include reverse osmosis membrane, pressure vessels, pre-filtration system, high pressure pump and all required piping, wiring and controls for a fully operational system, arranged on the frame to allow easy access for operating, maintenance and repair.

C. Performance Requirements:

1. The distribution system will be capable of delivering AAMI quality water at 15 PSIG minimum to each station and maintain 3 fps (feet per second) minimum flow velocity on the loop return to the storage tank during peak demand.
2. Blend City feed water to 75-77°F.
3. Regulate water pressure to 62 PSI maximum.
4. Membrane reject ratio: 98% minimum. TDS of product is 2% maximum of input TDS.
5. Reverse Osmosis system shall be capable of 19 LPM (5 GPM) flow rate.

6. Capture rate: 70% minimum. Maximum amount of water to drain is 30% of input.
- C. RO Membrane Elements: Membrane composition shall be thin-film composite (TFC), spiral wound. Membrane shall be 4" dia. by 40" long, full-fit, with 85 ft<sup>2</sup> (nominal) surface area. The design salt rejection shall be 99% based on 2000 ppm water at 225 psig at 77 degrees F.
- D. RO Element Housings: Type 316 stainless steel with PVC end caps held in place with stainless steel bands. Each housing assembly complete with one set of O-rings and O-ring lubricant. Housing assembly shall be 300 PSIG Non-ASME code stamped. Connections shall be end/side entry, feed/concentrate NPTF. Provide cleaning connections.
- E. High Pressure Pumps and Motors: Single vertical multistage high efficiency centrifugal type with Type 304 stainless steel casing, shaft, impellers. Tungsten carbide and ceramic shaft seals. Cast iron frame with flanged piping connections. Premium efficiency TEFC 3500 RPM electric motor selected to be non-overloading on the entire performance curve. Electrical motor shall be TEFC 3 Hp, and shall require 460V, 3 phase electrical power.
- F. Manual Valves:
  1. Inlet Isolation Valve, Product and Concentrate Check Valves: PVC with EPDM seats and seals.
  2. Sample Valve, Product Water Sample Valve: PVC plug valve with EPDM seats and seals.
  3. High Pressure Sample Valve: Type 316 stainless steel plug valve.
- G. Automatic Valves:
  1. Pump Discharge Throttle Valve: Solenoid-actuated, Type 316 stainless steel ball valve, threaded ends.
  2. Concentrate Throttle Valve, Recycle Throttle Valve: Solenoid-actuated, stainless steel, rated for 300 psi minimum.
  3. Feedwater Valve: Solenoid-actuated PVC ball valve with EPDM seats and seals.
- H. Pressure Gauges and pressure Switches:
  1. Pressure gauges shall be provided on the RO filter housing inlet (RO feed)/outlet, RO pump discharge, membrane feed and concentrate piping. Pressure switches on RO feed (low) and RO pump discharge (high).
- I. Flow Indicators:
  1. Flow indicators shall be provided for RO permeate, concentrate and concentrate recycle. Conductivity monitoring provided for RO feed and permeate.
- J. Piping within skid assembly:
  1. Low Pressure Feed, Reject and Recycle Piping (75 psi and under): ASTM D1785, Schedule 80 PVC, socket welded and flanged.
  2. RO Product Tubing From Each Membrane Housing: ASTM D1785, Schedule 80 PVC, socket welded and flanged.
  3. Low Pressure Control and Pressure Gage Tubing: Polyethylene.
  4. High Pressure Reject and Recycle Piping (above 75 psi): ASTM A269, Type 304 Schedule 10 stainless steel with butt welded joints.
  5. Connections with valves shall be provided for cleaning and sanitizing of RO membranes.

K. Controls:

1. One electrical connection (460V/3Ph/60Hz) at NEMA 4X motor starter, disconnect, and with a step-down transformer to the microprocessor control, all shall be UL Listed. RO normal automatic service shall be interlocked with storage tank level and Ultra-violet sterilizer. All will shut down on low level signal from storage tank. Control system shall also include elapsed run time indicator, associated lights for system status, and alarm horn and output. Alarms for low product quality, high pressure pump discharge, low feed pressure, high feed/product water temperature, output overload. All wiring factory-installed and tested. Comply with Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW) and NFPA 70.
2. Auto flush indicator and control to flush RO concentrate at shut down or at predetermined intervals.
3. Warning Alarms: Low quality product, low feed pressure, high feed temperature.
4. Automatic Shutdowns and Alarms: Low feed pressure, low product quality, pretreatment out of service, storage tank full.
5. Status Indicators: Low feed pressure, low quality, flow alarm, high feed water temperature, product divert to drain valve open, pretreatment lockout, storage tank full.
6. Low and High pressure safety switches.
7. Tank water level control switches.
8. Pump Motor Starter: Comply with Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.
9. Miscellaneous Controls: Elapsed run time indicator, alarm horn, chemical pump receptacles, convenience receptacles, auxiliary contacts.
10. Equipment supplying contractor shall be responsible for all necessary wiring between control panel and electrical disconnect box.

L. Instrumentation and Displays:

1. All instrumentation readouts panel-mounted in FRP enclosures rated NEMA 4. All factory wiring. Comply with NFPA 70.
2. Digital flow indicators for, product, reject, recycle.
3. Pressure gages for inlet, cartridge filter outlet, RO feed, RO concentrate, and RO product.
4. Conductivity indicator measuring product quality with digital displays, alarm relays and automatic temperature compensation.
5. Conductivity probe mounted in the RO product.

M. Skid and Frame Assembly:

1. RO machine shall be built on a skid and frame constructed of welded structural carbon steel. The entire surface shall be sand-blasted and polyurethane coated, textured.
2. Provide vibration isolation assembly under each support point of support frame. See SECTION 22 05 11 COMMON WORK RESULTS FOR PLUMBING for specification.

N. Reassembly:

1. Unit shall be shipped to the site completely assembled and tested. If units or sections are to be disassembled at the site to allow for installation in a limited space, the unit shall be reassembled and tested for intended operation.

## 2.2 PRE-FILTER

- A. Single multi-media filter sized for the RO machine inlet flow rate. Filter designed for suspended solids removal down to 5 microns polypropylene media cartridge.
- B. Media Tank: FRP designed for 150 psi. Pre-piped internal backwash distributor and filtered water collector.
- C. Filter Media: Top layer of anthracite, middle layer of silica sand, bottom layer of multi-grade garnet. Install filter media at job site.
- D. Backwash Cycle: Top-mounted, piston-operated control valve with pre-sized drain line flow control orifice. The cycle shall be initiated by and adjustable seven day electronic time clock. Include RO lockout switch. Equipment supplying contractor shall be responsible for all necessary wiring between filter electrical connection and junction box.
- E. Replacement Filter Media: Provide elements for one complete replacement.

## 2.3 QSR ACTIVATED CARBON FILTRATION

- A. Function: Chlorine / chloramines reduction
- B. Description:
  - 1. Material of construction: FRP
  - 2. Pressure rating: 80 PSIG
  - 3. Connections: 1" Quick disconnect w/ hoses
  - 4. Media: QSR acid-washed activated carbon
  - 5. Carbon volume: Approx. 3.2 ft<sup>3</sup> per service SDI unit
  - 6. Design flow rate: Approx. 1 GPM/ft<sup>3</sup> (10 minutes EBCT)
  - 7. Manufacturer: Mar Cor Purification, or equal.
- C. Number of service SDI units to be determined by volume of carbon required to achieve 10 minutes of empty bed contact time (EBCT). Required number of units should be rounded up to be even, enabling two parallel banks in lead - lag configuration, each with 5 minutes EBCT. Isolation valves required for each unit. Sampling valves required on the outlet of each unit prior to the outlet isolation valve.
- D. Flow indicator required downstream of the activated carbon filters to determine and regulate the EBCT.
- E. Carbon units must be provided by a vendor operating under Quality System Requirements (QSR).
- F. A painted steel (or powder-coated) seismic-rated frame (AKA "bottle rack") will be provided to constrain the carbon bottles from tipping in a seismic event. The bottle rack will be designed to include the SDI valve and hose manifolds in such a fashion that the hoses hang down, connecting to the bottles in an orderly fashion. Draped or tangled hoses will not be accepted. The bottle rack manifold will include the necessary pressure gauges, sample ports and isolation valves and shall be flanged on inlet and outlet for ease of installation. The bottle rack shall be anchored per CA PE wet-stamped anchoring calculations. A removable bar(s) will be provided so that bottles can be exchanged without tipping or lifting.



## 2.4 RO WATER STORAGE TANK

- A. Free-standing, closed-top, cone-bottom, 0.95 cubic Meter (250 gallons) total volume. Top access 8 inch gasketed cover access, PVC bulkhead fittings for high and low level alarm switches, RO permeate inlet, RO permeate discharge and drain. Tank and stand diameter shall be no greater than 1067 mm (42-inch) diameter.
- B. Materials of Construction: High density linear polyethylene storage tank. Wall thickness shall be calculated in accordance with ASTM D1998. Tanks shall be designed with hoop stress no greater than 600 PSI. The top shall be the same thickness as that of the walls
- C. Stand: Reinforced polypropylene frame stand. Provide two layers of neoprene pad under each leg of stand for vibration isolation. See SECTION 22 05 11 COMMON WORK RESULTS FOR PLUMBING for specification.
- D. Tank Vent Filter: White polypropylene housing with ¾ inch connection, and 0.2 micron polypropylene (hydrophobic) cartridge with less than 0.1 PSI drop at maximum tank drawdown.
- E. Spray Ball: Teflon, ¾ inch connection, 180 degree spray pattern spray head.
- F. Tank Level Controls:
  - 1. High Level RO system off
  - 2. Mid Level RO system on
  - 3. Low Level Dialysis system alarm
  - 4. Low-low Level Distribution pump off
- D. Tank Water Level Control: Adjustable float switch that signal starting and stopping RO pump. High and low level alarm switches.

## 2.5 CIRCULATING PUMP

- A. Pump shall be 316 stainless steel construction, centrifugal pump with TEFC, 3500 RPM high efficiency, 1 HP electric motor, 460VAC - 3 phase.
- B. Pump shall be capable of delivering min. 0.50 LPS (8 GPM) at 448 kPa (65 PSI) into distribution loop and maintain min. 0.92 MPS (3 FPS) velocity.
- C. Pump control panel shall be NEMA 4 and UL Listed. It shall include one point electrical connection, magnetic starter and disconnect switch, transformer for control circuit, power-on LED, pump run LED, pump off LED, HOA switch, variable speed drive motor, pressure and flow switches, UV sterilizer, HOA switch, interlock with storage tank level, and shut down on low level signal from tank level.

## 2.5 PRESSURE GAGES

- A. See SECTION 22 05 19, METERS AND GAUGES FOR PLUMBING PIPING, and as specified below.
- B. ASME B40.100, Grade A, 1% accuracy, 110 mm (4-1/2 inches) diameter, all metal case, bottom connected. White dials, black hands, graduated from 0 to 700 kPa (0 to 100 psi) and identity labeled.

## **2.6 ULTRA-VIOLET STERILIZER**

- A. Material of construction shall be 316L SST chamber, with 304 stainless steel cabinet, RF flange connections, 254 nM bacteria reduction UV lamp, >30,000 microW - s/cm<sup>2</sup> dosage.
- B. UV sterilizer shall be interlocked with distribution pump. Intensity meter shall be included to monitor lamp 254-nM output.

## **2.7 ULTRA-FILTRATION**

- A. White polypropylene filter housing for hollow fiber polysulfone with polypropylene support, 0.05-micron absolute cartridge, 2.0 GPM per 10-inch cartridge.

## **2.8 WATER TESTING EQUIPMENT:**

- A. Furnish water testing equipment in a portable cabinet specially made for the installed equipment. Include sufficient materials for 6 months of normal testing procedures.
- B. Silt Density Index (SDI) apparatus to measure degree of suspended solids feeding the RO membranes. Include pressure regulator, pressure gage, filter holder, 600 mL beaker, sample valve, tubing and 0.45 micron filter papers.
- C. Test kit to measure total water hardness, total iron, free chlorine, pH.

## **PART 3 - EXECUTION**

### **3.1 REQUIRED TECHNICAL SERVICES:**

Provide services of a qualified manufacturer's representative to check complete installation for conformance to manufacturer's recommendations, put system into service, make all adjustments required for full conformance to design and specified requirements, and perform all demonstrations and tests.

### **3.2 GENERAL INSTALLATION:**

- A. Provide full size by-pass with valve between inlets and outlets of filters, UV sterilizer for serviceability of equipment.

### **3.3 FLUSHING AND DISINFECTING:**

- A. Flush and disinfect new water lines and RO system and tank interiors in accordance with AWWA C651.
- B. Material:
  - 1. Liquid chlorine: AWWA B301.
  - 2. Hypochlorite: AWWA B300.

**3.4 STARTUP AND TESTING:**

- A. Operating: Tests shall be run in presence of Contracting Officers Technical Representative (COTR).
- B. Procedure:
  - 1. Operate RO system at constant maximum required capacity for one hour after demineralized RO product water is produced. When necessary, waste product water to sewer to maintain above flow rate. Product water production shall begin when a sample shows that demineralization complies with requirements.
  - 2. Demonstrate all features of the control system including diagnostics and flow and cycle indications.
- C. 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.

**3.5 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.
- C. Manufacturer FDA certified system commissioning required and approval by manufacturer.

**3.6 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.

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**SECTION 22 67 19.21  
DIALYSIS EQUIPMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Provide complete equipment for processing and mixing acids and bicarbonate solutions for dialysis stations. Equipment shall include water softening equipment and reverse osmosis unit. Designed for continuous automatic operation. The system shall include necessary filters, pumps, product storage tank and all devices necessary for fully operational system. Water quality shall comply with AAMI requirements.

**1.2 RELATED WORK**

- A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- B. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- C. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS. Requirements for commissioning, systems readiness checklist, and training.
- D. Section 22 67 19.16, REVERSE OSMOSIS WATER EQUIPMENT.
- E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATION.

**1.3 QUALITY ASSURANCE**

Manufacturer shall have been engaged in the manufacturing of dialysis equipment and systems as a primary product for at least ten years. The ten year requirement supersedes any conflicting requirement in other parts of the project specification.

**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. Catalog cuts, complete description and specifications of all equipment and accessories.
  - 2. Acid mixing equipment and associated pumps.
  - 3. Bicarbonate mixing and distribution equipment and associated pumps.
  - 4. Accessories including filters, pressure gages and test kit.
  - 5. Performance data including normal and maximum flow and pressure drop. Certification that required performance will be achieved.
  - 6. Piping, fitting, and valves.
  - 7. Pressure regulators.
  - 8. Pressure gages.
  - 9. Dialysis system control panel.
  - 10. Dialysis station outlet box.
  - 11. System Process and Instrumentation diagram.
- C. Complete detailed layout, setting, arrangement, and installation drawings including all pumps, filters, valves, and drainage piping.

Drawings shall also show all parts of the apparatus including relative positions, dimensions, and sizes and general arrangement of connecting piping.

- D. 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.
- E. Provide seismic restraint design and shop drawings per Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

#### 1.5 PROJECT CONDITIONS

- A. Incoming water is pre-treated by water softener and reverse osmosis unit to produce AAMI quality water for dialysis treatment. Acids and bicarbonate equipment for centralized mixing and delivered to dialysis stations. Each dialysis station is to be supplied from a centralized acid and bicarbonate distribution system.

#### 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 of Mechanical Engineers (ASME):  
B40.100-2005.....Pressure Gages and Gage Attachments
- C. ASTM International (ASTM):  
A269-07.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service.  
D1785-06.....Poly (Vinyl Chloride) (PVC) Plastic Pipe,  
Schedules 40, 80, and 120.
- D. American Water Works Association (AWWA):  
B300-04.....Hypochlorites  
B301-04.....Liquid Chlorine  
C651-05.....Disinfecting Water Mains
- E. National Electrical Manufacturers Association (NEMA):  
ICS-6-1993(R2001, R2006).....Industrial Control and Systems:  
Enclosures
- F. National Fire Protection Association (NFPA):  
70- 08 .....National Electrical Code.
- G. Department of Health and Human Services, Food and Drug Administration (FDA):  
CFR 21, Chapter 1, Part 175.300, 02 Resinous and Polymeric Coatings

## **PART 2 - PRODUCTS**

### **2.1 PIPING AND FITTING**

- A. Inside Mechanical room (between equipment): Schedule 80 (PVC) polyvinyl chloride, pressure rated piping conforming to ASTM D1785, and Schedule 80 fitting conforming to ASTM D4101 and ASTM D2657 for thermal socket fusion joints, and 150 PSI rated.
- B. Overhead Distribution systems: Ultra-high purity, 316L stainless steel tubing conforming to ASME B31.1. Fittings shall be butt weld fittings. All piping and fittings shall be factory cleaned and packaged in an ISO Class 4 / Federal Class 10 clean room.
- C. Utility box Connection: Fluoropolymer (PTFE) tubing, conform with ASTM D-3295, Type II fractional inch sizes, Class D chemical tubing, with 0.0625 inch wall, compatible with corrosive liquids. Tubing shall be joined with fine thread flare PFA elbow, tee, and adaptor fittings. Provide adaptor to joint stainless steel tubing with PTFE tubing.
- D. Quick Disconnect: Both ends of PTFE tubing shall have quick disconnects with hose barb ends. Quick couplers shall be polysulfone material, USP Class VI, ADCF, with polysulfone locking sleeve, polysulfone thumb latch, and silicone USP class VI ADCF O-rings. Verify exact size required at the dialysis boxes.

### **2.2 VALVES**

- A. True union, PVC body, quarter-turn ball valve.
- B. Stainless steel body, quarter-turn valve with extensions for orbital welding.

### **2.3 ACID MIXING EQUIPMENT**

- A. Acid tanks:
  - 1. Each tank shall be white polypropylene (PP), or white polyethylene (PE), 300 gallons volume, 35.5-inch diameter, flat bottom, cover lid with manway, and complete with tank fill valve, and bottom tank drain valve.
  - 2. Three tanks (one each, for 1K, 2K & 3K concentrations).
- B. Pumps and Motors: Single magnetic drive type centrifugal pump with GRFPP construction, casing, and impellers, ceramic or PE spindle, PTFE bearing, ceramic thrust rings, and KFM or EPM O-rings. Premium efficiency TEFC motor selected to be non-overloading on the entire performance curve.
  - 1. Pump capacity shall be max 55 LPM (15 GPM at 4 M (12 Feet) head, 1/8 Hp, 1.6 amps, 120V - single phase motor, 3400 RPM.
- C. All wiring factory-installed and tested. Comply with Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW) and NFPA 70.
- D. Equipment supply contractor shall provide all wiring from electrical outlet to equipment.

E. Provide two layers of neoprene pads under each support point of acid tank assembly. See SECTION 22 05 11, COMMON RESULT WORKS FOR PLUMBING for specification.

F. Provide seismic bracing for each tank. See Section 130541.

#### **2.4 BICARBONATE MIXING SYSTEM:**

A. Bicarbonate mixing system shall be complete with dual polyethylene construction 100 gallon tanks, mixing pump, distribution pump, controls, valves, and filter. The skid shall be no more than 1067 mm (42-inch) depth. System shall be supported by a reinforced polypropylene frame that allows easy access to all components. The dual bicarbonate mixing / dispensing system shall be capable of receiving max. 65 PSI pressure and 85 degrees F RO (Reverse Osmosis) water produced to AAMI Standards for Hemodialysis.

1. Mixing Pump shall be .75 Hp, 120VAC-single phase TEFC electric motor, stainless steel construction centrifugal pump.
2. Distribution Pump shall be 1/9 Hp, 120VAC-single phase TEFC electric motor, GFRPP polypropylene construction, magnetic drive pump.
3. Valves: Valve construction shall be PVC to match piping material, and compatible with solutions within piping.
4. Final filter: 30 micron cartridge filter and housing.
5. Interconnecting piping within the skid shall be Sch 80 PVC.
6. All piping on skid shall be factory pre-piped, and tested.

B. Capacity of distribution system shall deliver up to 4 GPM of solution to the distribution loop and return piping system at 10 PSIG.

C. Instrumentation and Displays:

1. All instrumentation readouts panel-mounted in FRP enclosures rated NEMA 4. All wiring factory-installed and tested. Comply with Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW) and with NFPA 70.
2. Control panel shall include power disconnect switch, independent start/stop switch for each pump, flow switch to protect pumps from dry runs, batch controller to measure correct volume of feed-water into mixing tank, solenoid valve, level control in mixing tank, alarm light for low level in distribution tank, audible alarm and silence button.
3. Instrumentation shall be capable of all operations, including cleaning. The Programmable Logic Controller (PLC) shall maintain automatic operational requirements.
4. Pressure gages shall be provided on inlet, cartridge filter outlet, RO feed, RO concentrate, and RO product.
5. Shut down alarms shall include:
  - a. Low flow switch to shut down mixing pump.
  - b. Low flow switch to shut down distribution pump.
  - c. Low tank level alarm.

D. Reassembly:

1. Unit shall be shipped to the site completely assembled and tested. If units or sections are to be disassembled at the site to allow for installation in a limited space, the unit shall be reassembled and tested for intended operation.

- E. Provide two layers of neoprene pad under each support point of assembly. See SECTION 22 05 11, COMMON RESULT WORKS FOR PLUMBING for specification.

## **2.5 PRESSURE GAGES**

- A. ASME B40.100, Grade A, 1% accuracy, 110 mm (4-1/2 inches) diameter, all metal case, bottom connected. White dials, black hands, graduated from 0 to 700 kPa (0 to 100 psi) and identity labeled.
- B. Provide gauge guard on gauge connection to piping.

## **2.6 DIALYSIS STATION OUTLET BOXES**

- A. Molded plastic recessed wall box complete with three (3) Fresenius acid concentrate connectors and shut-off valves, one (1) bicarbonate concentrate connector and shut-off valve, and one polysulfone and EPDM seal quick disconnect connector for dialysis machine drain connection.
- B. Access shall be from the front of the outlet box.

## **2.7 DIALYSIS CONTROL PANEL**

- A. The dialysis water system control panel shall be PLC-based and shall serve as the primary interface between all of the components. It shall monitor the RO system alarm status, low storage tank level, low water quality with conductivity meter, low return with end-of-loop flow switch. It shall function as a local alarm and send signal to remote alarm at nurse's station. It shall function as a CIP/sanitization control panel.
- B. Entire panel shall be NEMA 4 and UL Listed. Panel shall be connected to a dedicated 120VAC - single phase electrical power.
- C. Equipment supplier shall provide and install all wiring and conduit necessary for connecting Dialysis control Panel to Remote Alarm Panel at Nurse's station.

## **PART 3 - EXECUTION**

### **3.1 REQUIRED TECHNICAL SERVICES:**

Provide services of a qualified manufacturer's representative to check complete installation for conformance to manufacturer's recommendations, put system into service, make all adjustments required for full conformance to design and specified requirements, and perform all demonstrations and tests.

### **3.2 INSTALLATION**

- A. All equipment will be installed per the manufacturers' recommendations and located to permit ample accessibility for service and maintenance.
- B. Interconnecting piping is to be installed per the water equipment supplier's P&ID with Schedule 80 PVC piping.
- C. Provide PTFE tubing between stainless steel tubing and dialysis box connections with quick coupler connections on acid supplies and bicarbonate inlets. See detail on plans. PTFE tubing shall be no more



than 36 inches long, and the connections to dialysis box shall have quick couplers.

- C. Provide all valves necessary for complete operation, serviceability, and sanitization of system.
- D. Provide all instrumentation and gauges and install per the manufacturers' recommendations. Locate for easy reading and maintenance from the floor. Instrumentation to be factory-calibrated by the instrument manufacturer to ensure accuracy.
- E. Equipment supplying contractor shall be responsible for all necessary wiring. Provide all interconnecting power and control wiring to the control panels and between the control panels and instrumentation. Power drops required for each panel - complete with disconnect and breaker - and to be supplied by other trades. The dialysis control panel is required to have its own dedicated circuit.

### **3.3 STARTUP AND TESTING:**

- A. Operating: Tests shall be run in presence of Contracting Officers Technical Representative (COTR).
- B. Procedure:
  - 1. Operate each acid system at maximum required capacity for one hour after completing installation of tank and pump. Mix acid solution and circulate through piping system.
  - 2. Demonstrate all features of each acid system for operation and function through min. of two cycles.
  - 3. Bicarbonate mixing equipment shall be demonstrated to operate and functional through min. of two cycles.
  - 4. Solution shall be drawn from each dialysis station to demonstrate quantity and operation of each acid and bicarbonate outlet.
- C. 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.

### **3.4 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.

### **3.5 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.

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**SECTION 23 37 00  
AIR OUTLETS AND INLETS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Air Outlets and Inlets: Diffusers, Registers, and Grilles.

**1.2 RELATED WORK**

- A. Seismic Reinforcing: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**1.3 QUALITY ASSURANCE**

- A. 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. Diffusers, registers, grilles and accessories.
- C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 01 33 23

**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 4<sup>th</sup> 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-2012.....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 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. Supply Outlets:

1. Ceiling Supply Diffuser (CSD-1):

- a. Suitable for T-bar ceiling system and have a perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers and no less than 51 percent free area. Perforated face shall be steel. The backpan shall be one piece stamped heavy gauge steel of the sizes and mounting types shown on the plans and outlet schedule. The diffuser neck shall have 1 1/8-inch depth for easy duct connection.
- b. Diffusers must discharge a uniform horizontal blanket of air into the room and protect ceiling against smudging. Pattern controllers in the supply models shall be mounted on the back of the perforated face and must be field adjustable to allow the discharged air to enter the room in either vertical or one-, two-, three- or four-way horizontal jets. The perforated face must be easily unlatchable from the backpan to facilitate option of the face for pattern controller adjustment or to access an optional damper.
- c. The finish shall be white or specified otherwise by architect and/or Contracting Officer's Representative. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
- d. The manufacturer shall provide published performance data for the perforated diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

2. Ceiling Supply Diffuser (CSD-2):

- a. Suitable for surface mounted application with 3/4-inch blade spacing. The deflection blades shall be available parallel to the short dimension of the grille. All supply grilles shall be

constructed with a 1¼-inch wide heavy aluminum border having a minimum thickness of 0.040-0.050 inch. Outer borders shall be assembled and interlocked at the four corners and mechanically staked to form a rigid frame. Screw holes shall be countersunk for a neat appearance.

- b. Blades shall be constructed of heavy duty aluminum and shall be contoured to a specifically designed airfoil cross-section to meet published performance data. Hollow blades are not acceptable. Blades must be solid. Blades shall extend completely through the side frame on each side to ensure stability throughout the complete cfm operating range of the grille. Blades shall be individually adjustable without loosening or rattling and shall be securely held in place with tension wire.
  - c. The grille finish shall be white or specified otherwise by architect and/or Contracting Officer's Representative. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
  - d. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.
3. Linear Slot Supply Diffuser (LD-1, LD-2):
- a. Suitable for special tile ceiling system with 3/4-inch slot spacing of the sizes and mounting types shown on the outlet schedule. Linear slot diffusers shall be available in standard one piece lengths up to 4 feet and 4 slots.
  - b. Diffuser lengths greater than 4 feet shall be furnished in multiple sections and will be joined together end-to-end with alignment pins to form a continuous slot appearance.
  - c. The finish shall be white on the face and black on the pattern controllers, or specified otherwise by architect and/or Contracting Officer's Representative. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
  - d. Heavy gauge extruded aluminum end borders, end caps and mitered corners shall be available to close off the ends of the diffusers. Plenums shall be manufactured by the same manufacturer of the linear slot diffusers. Optional diffuser curving to a 6-foot minimum radius with fixed deflection shall be available as required.
  - e. The manufacturer shall provide published performance data for the linear slot diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.
4. Linear Slot Supply Diffuser (LD-3):
- a. Complete with single 2"-slot for supply air. Provide all continuous linear slot diffusers as shown on the drawings. The slot diffusers shall integrate into the ceiling system.
  - b. Customize diffuser shape to meet ceiling design per contract document.

- c. Linear diffusers supported by screws in the flanges or from air plenums are unacceptable. For hard ceilings, provide clips that are integral with the linear slot diffusers allowing the diffusers to be secured directly to the ceiling framing without the requirement for hanger supports.
  - d. Provide ends and corners as required. Ends shall be butt type, field installed, or mitered picture frame type factory installed, as indicated herein or shown on the drawings. Corners shall be mitered one piece unit.
  - e. Material shall be minimum wall thickness 0.062 inches extruded aluminum. Spring steel retainers shall be used under the spacers to hold the slot diffusers assembly tightly together and allow the slot diffusers to be disassembled easily for field trimming.
  - f. Flanges exposed to view shall be painted factory standard white. All other surfaces shall be painted flat black. Provide paint samples if requested.
  - g. Plenums shall be minimum 24-gauge galvanized steel.
- D. Return / Exhaust Register and Grille:
- 1. Ceiling Return/Exhaust Register (CRR-1, EXH-1) shall have the same face and border construction as the supply models for harmonious appearance in the room; see Section 2.2.C.1.
  - 2. Linear Slot Return Register Type 1 (LR-1) shall be constructed the same as supply diffusers without the pattern controllers; see Section 2.2.C.2.
  - 3. Linear Slot Return Register Type 2 (LR-2 and LR-3): shall be constructed the same as supply diffusers; see Section 2.2.C.4.
    - a. LR-3: Customize diffuser shape to meet ceiling design per contract document.
  - 4. Side-Wall Exhaust Grille (EXH-2):
    - a. Suitable for side-wall installation with 3/4-inch blade spacing. The fixed deflection blades shall be available parallel to the short dimension of the grille. Construction shall be of extruded aluminum with a 1-1/4 -inch wide border on all sides and shall be interlocked at the four corners and mechanically staked to form a rigid frame. Minimum border thickness shall be 0.040 to 0.050 inch. Screw holes shall be countersunk for a neat appearance.
    - b. Blades shall be contoured to a specifically designed and tested cross-section to meet published performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed in place by crimping or welding. Blade shall have a fixed deflection angle of 0°.
    - c. The grille finish shall be white or specified otherwise by architect and/or Contracting Officer's Representative. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
    - d. The grille finish shall be white or specified otherwise by architect and/or Contracting Officer's Representative. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint

must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

- e. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, 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 Contracting Officer's Representative. Protect equipment during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.

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**SECTION 26 05 11  
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, panelboards, and other items and arrangements for the specified items are shown on drawings.
- C. Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

**1.2 MINIMUM REQUIREMENTS**

- A. References to the International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

**1.3 TEST STANDARDS**

- A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.
- B. Definitions:
  - 1. Listed; Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed equipment or materials or periodic evaluation of services, and whose listing states that the equipment, material, or services either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
  - 2. Labeled; Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production



- of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified; equipment or product which:
    - a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
    - b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
    - c. Bears a label, tag, or other record of certification.
  4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

#### **1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)**

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- B. Product Qualification:
  1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
  2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

#### **1.5 APPLICABLE PUBLICATIONS**

Applicable publications listed in all Sections of Division are the latest issue, unless otherwise noted.

#### **1.6 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class or type of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
  1. Components of an assembled unit need not be products of the same manufacturer.
  2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  3. Components shall be compatible with each other and with the total assembly for the intended service.
  4. Constituent parts which are similar shall be the product of a single manufacturer.

- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
  - 1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the Resident Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.
  - 2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.
  - 3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

#### **1.7 EQUIPMENT REQUIREMENTS**

Where variations from the contract requirements are requested in accordance with Section 00 72 00, GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

#### **1.8 EQUIPMENT PROTECTION**

- A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
  - 1. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to switchgear, switchboards, panelboards, transformers, motor control centers, motor controllers, uninterruptible power systems, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, electronic equipment, and accessories.
  - 2. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
  - 3. Damaged equipment shall be, as determined by the Resident Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
  - 4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
  - 5. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

#### **1.9 WORK PERFORMANCE**

- A. All electrical work must comply with the requirements of 2011 NFPA 70 (NEC), NFPA 70B, 2012 NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished

in this manner for the required work, the following requirements are mandatory:

1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with 2012 NFPA 70E.
  2. Electricians must wear personal protective equipment while working on energized systems in accordance with 2012 NFPA 70E.
  3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the Resident Engineer and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways.
  4. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the Resident Engineer.
- D. For work on existing stations, arrange, phase and perform work to assure electrical service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interferences.

#### **1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS**

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working spaces shall not be less than specified in the NEC for all voltages specified.
- C. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  2. "Conveniently accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

#### **1.11 EQUIPMENT IDENTIFICATION**

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers (starters), fused and unfused safety switches, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

- B. Nameplates for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Nameplates for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 1/2 inch [12mm] high. Nameplates shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.
- C. Install adhesive arc flash warning labels on all equipment as required by 2012 NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm<sup>2</sup>), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

#### 1.12 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
  - 1. Mark the submittals, "SUBMITTED UNDER SECTION\_\_\_\_\_".
  - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
  - 3. Submit each section separately.
- E. The submittals shall include the following:
  - 1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
  - 2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and/or attached to the equipment.
  - 3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
  - 4. Parts list which shall include those replacement parts recommended by the equipment manufacturer.

F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
  - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
  - b. A control sequence describing start-up, operation, and shutdown.
  - c. Description of the function of each principal item of equipment.
  - d. Installation instructions.
  - e. Safety precautions for operation and maintenance.
  - f. Diagrams and illustrations.
  - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers and replacement frequencies.
  - h. Performance data.
  - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
  - j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of manuals together with shop drawings.

H. After approval and prior to installation, furnish the Resident Engineer with one sample of each of the following:

1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
2. Each type of conduit coupling, bushing and termination fitting.
3. Conduit hangers, clamps and supports.
4. Duct sealing compound.
5. Each type of receptacle, toggle switch, occupancy sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

**1.13 SINGULAR NUMBER**

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

**1.14 ACCEPTANCE CHECKS AND TESTS**

The contractor shall furnish the instruments, materials and labor for field tests.

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**SECTION 26 05 21**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

**1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
- C. 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.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 FACTORY TESTS**

Low voltage cables shall be thoroughly tested at the factory per NEMA WC-70 to ensure that there are no electrical defects. Factory tests shall be certified.

**1.5 SUBMITTALS**

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- 1. Manufacturer's Literature and Data: Showing each cable type and rating.
- 2. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the Contracting Officer's Technical Representative (COTR):
  - a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
  - b. Certification by the contractor that the materials have been properly installed, connected, and tested.

**1.6 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 reference in the text by designation only.

B. American Society of Testing Material (ASTM):

D2301-04.....Standard Specification for Vinyl Chloride  
Plastic Pressure-Sensitive Electrical Insulating  
Tape

C. National Fire Protection Association (NFPA):

70-2011.....National Electrical Code (NEC)

D. National Electrical Manufacturers Association (NEMA):

WC 70-09.....Power Cables Rated 2000 Volts or Less for the  
Distribution of Electrical Energy

E. Underwriters Laboratories, Inc. (UL):

44-05.....Thermoset-Insulated Wires and Cables

83-08.....Thermoplastic-Insulated Wires and Cables

467-071.....Electrical Grounding and Bonding Equipment

486A-486B-03.....Wire Connectors

486C-04.....Splicing Wire Connectors

486D-05.....Sealed Wire Connector Systems

486E-94.....Equipment Wiring Terminals for Use with Aluminum  
and/or Copper Conductors

493-07.....Thermoplastic-Insulated Underground Feeder and  
Branch Circuit Cable

514B-04.....Conduit, Tubing, and Cable Fittings

1479-03.....Fire Tests of Through-Penetration Fire Stops

**PART 2 - PRODUCTS**

**2.1 CONDUCTORS AND CABLES**

A. Conductors and cables shall be in accordance with NEMA WC-70 and as specified herein.

B. Single Conductor:

1. Shall be annealed copper.
2. Shall be stranded for sizes No. 8 AWG and larger, solid for sizes No. 10 AWG and smaller.
3. Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.

C. Insulation:

1. XHHW-2 or THHN-THWN shall be in accordance with NEMA WC-70, UL 44, and UL 83.

D. Color Code:

1. Secondary service feeder and branch circuit conductors shall be color-coded as follows:



208/120 volt	Phase	480/277 volt
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

- a. Lighting circuit "switch legs" and 3-way switch "traveling wires" shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COTR.
2. Use solid color insulation or solid color coating for No. 12 AWG and No. 10 AWG branch circuit phase, neutral, and ground conductors.
3. Conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
  - a. Solid color insulation or solid color coating.
  - b. Stripes, bands, or hash marks of color specified above.
  - c. Color as specified using 0.75 in [19 mm] wide tape. Apply tape in half-overlapping turns for a minimum of 3 in [75 mm] for terminal points, and in junction boxes, pull-boxes, troughs, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

## 2.2 SPLICES AND JOINTS

- A. In accordance with UL 486A, C, D, E, and NEC.
- B. Aboveground Circuits (No. 10 AWG and smaller):
  1. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F [105° C], with integral insulation, approved for copper and aluminum conductors.
  2. The integral insulator shall have a skirt to completely cover the stripped wires.
  3. The number, size, and combination of conductors, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Aboveground Circuits (No. 8 AWG and larger):
  1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
  2. Field-installed compression connectors for cable sizes 250 kcmil and larger shall have not fewer than two clamping elements or compression indents per wire.
  3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
  4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

### **2.3 CONTROL WIRING**

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified for power and lighting wiring, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be large enough such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

### **2.4 WIRE LUBRICATING COMPOUND**

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Install in accordance with the NEC, and as specified.
- B. Install all wiring in raceway systems.
- C. Splice cables and wires only in outlet boxes, junction boxes, pull-boxes, manholes, or handholes.
- D. Wires of different systems (e.g., 120 V, 277 V) shall not be installed in the same conduit or junction box system.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. For panel boards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.
- G. Wire Pulling:
  - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables. Use lubricants approved for the cable.
  - 2. Use nonmetallic ropes for pulling feeders.
  - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COTR.
  - 4. All cables in a single conduit shall be pulled simultaneously.
  - 5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- H. No more than three single-phase branch circuits shall be installed in any one conduit.

### **3.2 SPLICE INSTALLATION**

- A. Splices and terminations shall be mechanically and electrically secure.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque values.
- C. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

### **3.3 FEEDER IDENTIFICATION**

- A. In each interior pull-box and junction box, install metal tags on all circuit cables and wires to clearly designate their circuit identification and voltage. The tags shall be the embossed brass type, 1.5 in [40 mm] in diameter and 40 mils thick. Attach tags with plastic ties.

### **3.4 EXISTING WIRING**

Unless specifically indicated on the plans, existing wiring shall not be reused for a new installation.

### **3.5 CONTROL AND SIGNAL WIRING INSTALLATION**

- A. Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

### **3.6 CONTROL AND SIGNAL SYSTEM WIRING IDENTIFICATION**

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.

### **3.7 ACCEPTANCE CHECKS AND TESTS**

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices, such as fixtures, motors, or appliances. Test each conductor with respect to adjacent conductors and to ground. Existing conductors to be reused shall also be tested.
- B. Applied voltage shall be 500VDC for 300-volt rated cable, and 1000VDC for 600-volt rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300-volt rated cable and 100 megohms for 600-volt rated cable.
- C. Perform phase rotation test on all three-phase circuits.
- D. The contractor shall furnish the instruments, materials, and labor for all tests.

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**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the general grounding and bonding requirements for electrical equipment and operations to provide a low impedance path for possible ground fault currents.
- B. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
- C. Section 26 24 16, PANELBOARDS: Low voltage panelboards.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Clearly present enough information to determine compliance with drawings and specifications.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Contracting Officer's Technical Representative (COTR):
  - 1. Certification that the materials and installation are in accordance with the drawings and specifications.
  - 2. Certification by the contractor that the complete installation has been properly installed and tested.

**1.5 APPLICABLE PUBLICATIONS**

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.

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

B1-07.....Standard Specification for Hard-Drawn Copper Wire

B3-07.....Standard Specification for Soft or Annealed Copper Wire

B8-04.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-1983.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

C2-07.....National Electrical Safety Code

C. National Fire Protection Association (NFPA):

70-2011.....National Electrical Code (NEC)

99-2012.....Health Care Facilities

D. Underwriters Laboratories, Inc. (UL):

44-05 .....Thermoset-Insulated Wires and Cables

83-08 .....Thermoplastic-Insulated Wires and Cables

467-07 .....Grounding and Bonding Equipment

486A-486B-03 .....Wire Connectors

**PART 2 - PRODUCTS**

**2.1 GROUNDING AND BONDING CONDUCTORS**

A. Equipment grounding conductors shall be UL 44 or UL 83 insulated stranded copper, except that sizes No. 10 AWG [6 mm<sup>2</sup>] and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG [6 mm<sup>2</sup>] and smaller shall be ASTM B1 solid bare copper wire.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

**2.5 GROUND CONNECTIONS**

A. Below Grade: Exothermic-welded type connectors.

B. Above Grade:

1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.

## **2.6 EQUIPMENT RACK AND CABINET GROUND BARS**

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 0.375 in [4 mm] thick x 0.75 in [19 mm] wide.

## **2.7 GROUND TERMINAL BLOCKS**

At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

# **PART 3 - EXECUTION**

## **3.1 GENERAL**

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.
- B. System Grounding:
  1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
  2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.
- D. Special Grounding: For patient care area electrical power system grounding, conform to 2012 NFPA 99 and NEC.

## **3.2 INACCESSIBLE GROUNDING CONNECTIONS**

Make grounding connections, which are normally buried or otherwise inaccessible (except connections for which access for periodic testing is required), by exothermic weld.

## **3.3 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS**

- A. Transformers:
  1. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the ground bar at the service equipment.

### 3.4 RACEWAY

#### A. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
3. Conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

#### B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.

#### C. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

#### D. Wireway Systems:

1. Bond the metallic structures of wireway to provide 100% electrical continuity throughout the wireway system, by connecting a No. 6 AWG [16 mm<sup>2</sup>] bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG [16 mm<sup>2</sup>] bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 50 ft [16 M].
3. Use insulated No. 6 AWG [16 mm<sup>2</sup>] bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
4. Use insulated No. 6 AWG [16 mm<sup>2</sup>] bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 49 ft [15 M].

#### E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

#### F. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

#### G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

### 3.4 CORROSION INHIBITORS

When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

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**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 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.
- B. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.
- C. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.
- D. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- 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.

**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.
- B. Shop Drawings:
  - 1. Size and location of main feeders.
  - 2. Size and location of panels and pull-boxes.
  - 3. Layout of required conduit penetrations through structural elements.
- C. Certifications:
  - 1. Two weeks prior to the final inspection, submit four copies of the following certifications to the Contracting Officer's Technical Representative (COTR):

- a. Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.
- b. Certification by the contractor that the material has been properly installed.

#### 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):
  - 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):
  - 70-2011.....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
  - 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 0.5 in [13 mm] unless otherwise shown. Where permitted by the NEC, 0.5 in [13 mm] 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. Surface metal raceway: Shall conform to UL 5.
- C. Conduit Fittings:
  - 1. Rigid steel and IMC conduit fittings:
    - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
    - b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
    - c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
    - d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
    - e. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
    - f. Sealing fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
  - 3. Electrical metallic tubing fittings:
    - a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
    - b. Only steel or malleable iron materials are acceptable.
    - c. Compression couplings and connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
    - d. Indent-type connectors or couplings are prohibited.
    - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
  - 4. Flexible steel conduit fittings:
    - a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
    - b. Clamp-type, with insulated throat.
  - 5. Liquid-tight flexible metal conduit fittings:
    - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
    - b. Only steel or malleable iron materials are acceptable.

- c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- 6. Surface metal raceway fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
- 7. Expansion and deflection couplings:
  - a. Conform to UL 467 and UL 514B.
  - b. Accommodate a 0.75 in [19 mm] deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
  - c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
  - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.
- 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 COTR 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 COTR 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, except where shown on drawings.
- 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 COTR.

### 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 COTR 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 600 V and below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the same system is prohibited.
  - 2. Align and run conduit parallel or perpendicular to the building lines.
  - 3. 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.
  - 4. 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 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the system is prohibited.
- C. Align and run conduit parallel or perpendicular to the building lines.
- D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- E. Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
- F. Surface metal raceways: Use only where shown.
- G. 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 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.

### **3.6 WET OR DAMP LOCATIONS**

- A. Unless otherwise shown, use conduits of rigid steel or IMC.
- 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 or IMC conduit 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.

### **3.7 MOTORS AND VIBRATING EQUIPMENT**

N/A

### **3.8 EXPANSION JOINTS**

N/A

### **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.

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**SECTION 26 09 23  
LIGHTING CONTROLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation and connection of the lighting controls.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- C. 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.
- D. Section 24 26 16, PANELBOARDS: panelboard enclosure and interior bussing used for lighting control panels.
- E. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Product Data: For each type of lighting control, submit the following information.
  - 1. Manufacturer's catalog data.
  - 2. Wiring schematic and connection diagram.
  - 3. Installation details.
- C. Manuals:
  - 1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
  - 2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the Resident Engineer.
- D. Certifications:
  - 1. Two weeks prior to final inspection, submit four copies of the following certifications to the Resident Engineer:
    - a. Certification by the Contractor that the equipment has 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. Green Seal (GS):
  - GC-12.....Occupancy Sensors
- C. Illuminating Engineering Society of North America (IESNA):
  - IESNA LM-48.....Guide for Calibration of Photoelectric Control Devices
- D. National Electrical Manufacturer's Association (NEMA)
  - ICS-1.....Standard for Industrial Control and Systems  
General Requirements
  - ICS-2.....Standard for Industrial Control and Systems:  
Controllers, Contractors, and Overload Relays  
Rated Not More than 2000 Volts AC or 750 Volts  
DC: Part 8 - Disconnect Devices for Use in  
Industrial Control Equipment
  - ICS-6.....Standard for Industrial Controls and Systems  
Enclosures
- E. Underwriters Laboratories, Inc. (UL):
  - 20.....Standard for General-Use Snap Switches
  - 773.....Standard for Plug-In Locking Type Photocontrols  
for Use with Area Lighting
  - 773A .....Nonindustrial Photoelectric Switches for  
Lighting Control
  - 98.....Enclosed and Dead-Front Switches
  - 917.....Clock Operated Switches

## PART 2 - PRODUCTS

### 2.1 TIMER SWITCHES

- A. Digital switches with backlit LCD display, 120/277 volt rated, fitting as a replacement for standard wall switches.
  - 1. Compatibility: Compatible with all ballasts.
  - 2. Warning: Audible warning to sound during the last minute of "on" operation.
  - 3. Time-out: Adjustable from 5 minutes to 12 hours.
  - 4. Faceplate: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

### 2.2 INDOOR OCCUPANCY SENSORS

- A. Wall mounting, solid-state units with a power supply and relay unit, suitable for the environmental conditions in which installed.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a 1 to 15 minute adjustable time delay for turning lights off.
2. Sensor Output: Contacts rated to operate the connected relay. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20A ballast load at 120V and 277V, for 13A tungsten at 120V, and for 1 hp at 120V.
4. Mounting:
  - a. Sensor: Suitable for mounting in any position on a standard outlet box.
  - b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Manual/automatic selector switch.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc [21.5 to 2152 lx]; keep lighting off when selected lighting level is present.
9. Faceplate for Wall-Switch Replacement Type: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

### **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. Aiming for wall-mounted and ceiling-mounted motion sensor switches shall be per manufacturer's recommendations.
- C. Set occupancy sensor "on" duration to 15 minutes.
- D. Locate light level sensors as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for the scheduled light level at the typical work plane for that area.
- E. Label time switches and contactors with a unique designation.

#### **3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations.
- B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.
- C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range.
- D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.

#### **3.3 FOLLOW-UP VERIFICATION**

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function.

VAMC Palo Alto, CA

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**SECTION 26 27 26**  
**WIRING DEVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation and connection 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: Conduits and outlets boxes.
- C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): 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.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, dimensions, mounting details, construction materials, grade and termination information.
- C. Manuals: Two weeks prior to final inspection, deliver four copies of the following to the Resident Engineer: Technical data sheets and information for ordering replacement units.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer: Certification by the Contractor that the devices comply with the drawings and specifications, and have been properly installed, aligned, 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 basic designation only.

B. National Fire Protection Association (NFPA):

70-2011.....National Electrical Code (NEC)

C. National Electrical Manufacturers Association (NEMA):

WD 1.....General Color Requirements for Wiring Devices

WD 6 .....Wiring Devices - Dimensional Requirements

D. Underwriter's Laboratories, Inc. (UL):

5.....Surface Metal Raceways and Fittings

20.....General-Use Snap Switches

231.....Power Outlets

467.....Grounding and Bonding Equipment

498.....Attachment Plugs and Receptacles

943.....Ground-Fault Circuit-Interrupters

**PART 2 - PRODUCTS**

**2.1 RECEPTACLES**

A. General: All receptacles shall be listed by Underwriters Laboratories, Inc., and conform to NEMA WD 6.

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 min.) and side wiring from four captively held binding screws.

B. Duplex Receptacles: Hospital-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.

1. Bodies shall be ivory in color.

2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining 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.

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 five milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or - 1 milliamp) on the load side of the device. Device shall have a minimum nominal tripping time of 1/30th of a 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 phenolic compound supported by a plated steel mounting strap having plaster ears.
- C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete with appropriate cord grip plug. Devices shall meet UL 231.
- 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 bodies of phenolic compound. Toggle handles shall be ivory in color unless otherwise specified. The rocker type switch is not acceptable and will not be approved.
  - 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. Ratings:
    - a. 120 volt circuits: 20 amperes at 120-277 volts AC.
    - b. 277 volt circuits: 20 amperes at 120-277 volts AC.

## **2.3 MANUAL DIMMING CONTROL**

- A. slide dimmer with on/off control, single-pole or three-way as shown on plans. Faceplates shall be ivory in color unless otherwise specified.
- B. Manual dimming controls shall be fully compatible with electronic dimming ballasts and approved by the ballast manufacturer, shall operate over full specified dimming range, and shall not degrade the performance or rated life of the electronic dimming ballast and lamp.

## **2.4 WALL PLATES**

- A. Wall plates for switches and receptacles shall be type smooth nylon. Oversize plates are not acceptable.
- B. Color shall be ivory unless otherwise specified.
- C. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD 6.

- D. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- E. In psychiatric areas, wall plates shall be 302 stainless steel, have tamperproof screws and beveled edges.
- F. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.
- G. Duplex Receptacles on Emergency Circuit:
  - 1. Bodies shall be red in color. Wall plates shall be red with the word "EMERGENCY" engraved in 6 mm, (1/4 inch) white letters.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Installation shall be in accordance with the NEC and as shown as on the drawings.
- B. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the green equipment grounding conductor.
- C. Outlet boxes for light and dimmer switches shall be mounted on the strike side of doors.
- D. Provide barriers in multigang outlet boxes to separate systems of different voltages, Normal Power and Emergency Power systems, and in compliance with the NEC.
- E. Coordinate with other work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other work. 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.
- F. 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. In addition, check for exact direction of door swings so that local switches are properly located on the strike side.
- G. Install wall switches 48 inches [1200mm] above floor, OFF position down.
- H. Install wall dimmers 48 inches [1200mm] above floor; derate ganged dimmers as instructed by manufacturer; do not use common neutral.
- I. Install convenience receptacles 18 inches [450mm] above floor, and 6 inches [152mm] above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.
- J. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.
- K. 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.

L. Test GFCI devices for tripping values specified in UL 1436 and UL 943.

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**SECTION 26 29 21  
DISCONNECT SWITCHES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation, and connection of low voltage disconnect switches.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES 600 VOLTS AND BELOW: Cables and wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground faults.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, dimensions, mounting details, materials, enclosure types, and fuse types and classes.
  - 3. Show the specific switch and fuse proposed for each specific piece of equipment or circuit.
- C. Manuals:
  - 1. Provide complete maintenance and operating manuals for disconnect switches, including technical data sheets, wiring diagrams, and information for ordering replacement parts. Deliver four copies to the Contracting Officer's Technical Representative (COTR) two weeks prior to final inspection.
  - 2. Terminals on wiring diagrams shall be identified to facilitate maintenance and operation.
  - 3. Wiring diagrams shall indicate internal wiring and any interlocking.
- D. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the COTR:
  - 1. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.

2. Certification by the contractor that the materials have been properly installed, connected, 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. National Electrical Manufacturers Association (NEMA):
  - FU 1-07.....Low Voltage Cartridge Fuses
  - KS 1-06.....Enclosed and Miscellaneous Distribution  
Equipment Switches (600 Volts Maximum)
- C. National Fire Protection Association (NFPA):
  - 70-2011.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
  - 98-04.....Enclosed and Dead-Front Switches
  - 248-00.....Low Voltage Fuses
  - 977-94.....Fused Power-Circuit Devices

#### PART 2 - PRODUCTS

##### 2.1 LOW VOLTAGE FUSIBLE SWITCHES RATED 600 AMPERES AND LESS

- A. In accordance with UL 98, NEMA KS1, and NEC.
- B. Shall have NEMA classification General Duty (GD) for 240 V switches and NEMA classification Heavy Duty (HD) for 480 V switches.
- C. Shall be HP rated.
- D. Shall have the following features:
  1. Switch mechanism shall be the quick-make, quick-break type.
  2. Copper blades, visible in the OFF position.
  3. An arc chute for each pole.
  4. External operating handle shall indicate ON and OFF position and have lock-open padlocking provisions.
  5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable to permit inspection.
  6. Fuse holders for the sizes and types of fuses specified.
  7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
  8. Ground lugs for each ground conductor.
  9. Enclosures:
    - a. Shall be the NEMA types shown on the drawings for the switches.
    - b. Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions. Unless otherwise indicated on the plans, all outdoor switches shall be NEMA 3R.
    - c. Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel (for the type of enclosure required).

**2.2 LOW VOLTAGE UNFUSED SWITCHES RATED 600 AMPERES AND LESS**

Shall be the same as Low Voltage Fusible Switches Rated 600 Amperes and Less, but without provisions for fuses.

**2.3 LOW VOLTAGE CARTRIDGE FUSES**

- A. In accordance with NEMA FU1.
- B. Feeders: Class L, fast acting
- C. Other Branch Circuits: Class J, fast acting.
- D. Control Circuits: Class CC, fast acting.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install disconnect switches in accordance with the NEC and as shown on the drawings.
- B. Fusible disconnect switches shall be furnished complete with fuses. Arrange fuses such that rating information is readable without removing the fuse.

**3.2 SPARE PARTS**

Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fusible disconnect switch installed on the project. Deliver the spare fuses to the (COTR).

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**SECTION 26 51 00  
INTERIOR LIGHTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies the furnishing, installation and connection of the interior lighting systems.

**1.2 RELATED WORK**

- A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirement for seismic restraint for nonstructural Components.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
- C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): 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 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Product Data: For each type of lighting fixture (luminaire) designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of fixture designation, submit the following information.
  - 1. Material and construction details include information on housing, optics system and lens/diffuser.
  - 2. Physical dimensions and description.
  - 3. Wiring schematic and connection diagram.
  - 4. Installation details.
  - 5. Energy efficiency data.
  - 6. Photometric data based on laboratory tests complying with IESNA Lighting Measurements, testing and calculation guides.
  - 7. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours) and color temperature (degrees Kelvin).
  - 8. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts and total harmonic distortion (THD).
- C. Manuals:

1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the Resident Engineer.

D. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following certifications to the Resident Engineer:
  - a. Certification by the Contractor that the equipment has 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. Institute of Electrical and Electronic Engineers (IEEE):

C62.41-91.....Guide on the Surge Environment in Low Voltage  
(1000V and less) AC Power Circuits

C. National Fire Protection Association (NFPA):

70-2011.....National Electrical Code (NEC)

101-2012.....Life Safety Code

D. National Electrical Manufacturer's Association (NEMA):

C82.1-97.....Ballasts for Fluorescent Lamps - Specifications

C82.2-02.....Method of Measurement of Fluorescent Lamp  
Ballasts

C82.11-02.....High Frequency Fluorescent Lamp Ballasts

E. Underwriters Laboratories, Inc. (UL):

496-96.....Edison-Base Lampholders

542-99.....Lampholders, Starters, and Starter Holders for  
Fluorescent Lamps

844-95.....Electric Lighting Fixtures for Use in Hazardous  
(Classified) Locations

924-95.....Emergency Lighting and Power Equipment

935-01.....Fluorescent-Lamp Ballasts

1598-00.....Luminaires

1574-04.....Standard for Track Lighting Systems

2108-04.....Standard for Low-Voltage Lighting Systems

8750-08.....Light Emitting Diode (LED) Light Sources for Use  
in Lighting Products

F. Federal Communications Commission (FCC):

Code of Federal Regulations (CFR), Title 47, Part 18

**PART 2 - PRODUCTS**

**2.1 LIGHTING FIXTURES (LUMINAIRES)**

- A. Shall be in accordance with 2011 NFPA 70 and UL 1598, 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; lens doors shall close in a light tight manner.
  - 4. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, latches shall function easily by finger action without the use of tools.
- C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.
- D. Lamp Sockets:
  - 1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542. Lamp holders for bi-pin lamps shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.
- 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, 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 1/8 inch [3.2mm] of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.
  - 3. Unless otherwise specified, lenses, 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 of the lens without distortion or cracking.
- J. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Group areas as defined in 2011 NFPA 70, and shall comply with UL 844.
- 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 (not the lamp). Fixtures shall be designed for lamps as specified.

## **2.2 BALLASTS**

- A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V) electronic rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including 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 Rating: 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. Interference: Comply with 47 CFT 18, Ch.1, Subpart C, 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 10% of rated lamp lumens.
- B. Low-Frequency Linear T8 Fluorescent Lamp Ballasts (allowed for Surgery Suites, Critical Care Units and Animal Labs): 277V hybrid electronic-



electromagnetic rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output; including the following features:

1. Automatic lamp starting after lamp replacement.
  2. Sound Rating: Class A.
  3. Total Harmonic Distortion Rating: 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 47 CFT 18, Ch.1, Subpart C, 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, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including 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 Rating: 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 47 CFR 18, Ch. 1, Subpart C, 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 10% of rated lamp lumens.

## 2.5 LAMPS

- A. Linear and U-shaped T5 and T8 Fluorescent Lamps:
1. Rapid start fluorescent lamps shall comply with ANSI C78.1; and instant-start lamps shall comply with ANSI C78.3.
  2. Chromacity of fluorescent lamps shall comply with ANSI C78.376.
  3. 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) of greater than 70, average rated life of 20,000 hours, and be suitable for use with dimming ballasts, unless

otherwise indicated. Low mercury lamps shall have passed the EPA Toxicity Characteristic Leachate Procedure (TCLP) for mercury by using the lamp sample preparation procedure described in NEMA LL 1.

- 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.
- b. Other areas as indicated on the drawings.

B. Compact Fluorescent Lamps:

1. T4, CRI 80 (minimum), color temperature 3500 K, and suitable for use with dimming ballasts, unless otherwise indicated.

C. Long Twin-Tube Fluorescent Lamps:

1. T5, CRI 80 (minimum), color temperature between 3500° and 4100°K, 20,000 hours average rated life.

## **2.8 X-RAY FILM ILLUMINATORS**

- A. Shall be the high-intensity type, flush-mounted in the walls. Multiples of the basic unit may be combined in a common housing.
- B. Shall have the following features:
  1. Fluorescent lighting, designed to provide uniform diffusion of the light.
  2. Box dimensions approximately 21 inches [525mm] high, 14 inches [350mm] wide and 4 inches [100mm] deep.
  3. Frame shall be satin chrome-plated brass or stainless steel and shall extend approximately 1-1/2 inches [40mm] from the edges of the box.
  4. Viewing glass shall be the heat resistant, borosilicate type or 100 percent virgin acrylic plastic and not less than 1/8 inch [3mm] thick.
  5. Viewing glass shall have adequate dimensions so the films will not overlap the frame and will be positioned with respect to the light source for even illumination without shadows.
  6. An ON-OFF double-pole, double-throw switch.

## **2.9 EXIT LIGHT FIXTURES**

- A. Exit light fixtures shall meet applicable requirements of 2012 NFPA 101 and UL 924.
- B. Housing and Canopy:
  1. Shall be made of die-cast aluminum.
  2. Optional steel housing shall be a minimum 20 gauge thick or equivalent strength aluminum.
  3. Steel housing shall have baked enamel over corrosion resistant, matte black or ivory white primer.
- C. Door frame shall be cast or extruded aluminum, and hinged with latch.
- D. Finish shall be satin or fine-grain brushed aluminum.
- E. There shall be no radioactive material used in the fixtures.
- F. Fixtures:
  1. Maximum fixture wattage shall be 1 watt or less.

2. Inscription panels shall be cast or stamped aluminum a minimum of 0.090 inch [2.25mm] thick, stenciled with 6 inch [150mm] 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. The LED shall be rated minimum 25 years life.
3. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
4. 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 2012 NFPA 101.

G. Voltages: Refer to Lighting Fixture Schedule.

### **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. Fluorescent bed light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable.
- 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 fluorescent fixtures:
    - a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
    - b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.
  5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:
    - a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch [6mm] secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
    - b. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4 inch [6mm] studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the

ceiling. In lieu of the above, 1/4 inch [6mm] toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

6. 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 20 pounds [9kg] in weight.
    - 1) Where fixtures mounted in ASTM Standard C635-69 "Intermediate" and "Heavy Duty" ceilings and weigh between 20 pounds and 56 pounds [9kg and 25kg] provide two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
    - 2) Where fixtures weigh over 56 pounds [25kg] 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 1/4-20 [6mm] 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 56 pounds [25kg] 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 15 pounds [6.8kg] in weight and occupying less than two square feet [600mm x 600mm] 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 specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.
- F. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- G. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- H. Exercise electronic dimming ballasts 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.
- I. 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 a lesser period is specifically recommended by lamp manufacturer. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage. Replace any lamps and ballasts which fail during burn-in.
- J. At completion of project, relamp/reballast fixtures which have failed lamps/ballasts. Clean fixtures, lenses, diffusers and louvers that have accumulated dust/dirt/fingerprints during construction. Replace damaged lenses, diffusers and louvers with new.
- K. Dispose of lamps per requirements of Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

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**SECTION 27 08 11  
TESTING FOR COMMUNICATIONS**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. Section Includes: Testing of Telecommunications Cabling (Horizontal Cabling subsystems).

**1.2 REFERENCES**

1. ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
2. ANSI/TIA-568-C.2 Balanced Twisted Pair Cabling Components
3. BICSI Telecommunication Distribution Methods Manual.

**1.3 DEFINITIONS**

- A. In addition, define the following list of terms as used in this specification as follows:
1. "Channel": Shall mean a testing configuration which includes the Permanent Link and the line cord (at the workstation), the equipment cord, and, if a full crossconnection is implemented, a patch cord and the crossconnect termination/connecting apparatus.
  2. "Connect": Shall mean install all required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
  3. "Cord": Shall mean a length of cordage having connectors at each end. The term "Cord" is synonymous with the term "Jumper". The cord may be:
    - a. Unshielded twisted pair
  4. "Passive Link Segment": Shall mean the cable, connectors, couplings, and splices between two fiber optic termination units.
  5. "Permanent Link": Shall mean the 'permanent' portion of the Horizontal cabling to each outlet with the test cords de-embedded from the measurements; this includes cable, consolidation point (if used), termination/connecting apparatus in the IDF and the connector at the outlet.
  6. "System Cord": Shall mean the cord used in the operating electrical or optical circuit.
  7. "Test Cord": Shall mean the cord certified for use in testing, as described in this section.

**1.4 SYSTEM DESCRIPTION**

- A. Testing Requirements
1. Full testing of a completed communication infrastructure cabling system which includes:
    - a. Testing of the multipair cabling as follows:

**Table 16719-1.2: Tests For UTP Cabling**

Subsystem	Type	Test	Configuration	Notes
Horizontal	CAT6	Category 6	Permanent Link	Per TIA/EIA-568-B.2-1

- b. Record Documents, including test results.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. The manufacturer may change the product numbers listed in this Section at any time. In the event this Section contains an invalid product number or conflicts with the written description, notify the Engineer in writing prior to issuing submittals or field testing.

### **2.2 CATEGORY 6 HORIZONTAL CABLE TESTER**

- A. Equipment shall meet TIA/EIA-568B.2 Addendum 1 requirements for Level III accuracy.
- B. Test Standards (minimum): TIA Category 6 (per TIA/EIA-568B.2 Addendum 1); ISO/IEC 11801 Class C and D; ISO/IEC 11801-2000 Class C and D, 1000Base-T, 100Base-TX; IEEE 802.3 10Base-T; ANSI TP-PMD; IEEE 802.5
- C. Areas of Test Measurement (minimum): Wire Map; Length; Insertion Loss; Near End Crosstalk (NEXT) loss, at both master unit and remote unit; Power Sum NEXT (PSNEXT) loss, at both master unit and remote unit; Equal Level Far End Crosstalk (ELFEXT), at both master unit and remote unit; Power Sum ELFEXT, at both master unit and remote unit; Return Loss (RL), at both master unit and remote unit; Propagation Delay and Delay Skew; Attenuation-to-Crosstalk Ratio (ACR), at both master unit and remote unit; Power Sum ACR (PSACR), at both master unit and remote unit; Characteristic Impedance; DC Loop Resistance.

## **PART 3 - EXECUTION**

### **3.1 HORIZONTAL CATEGORY 6 TESTING PROCEDURES**

- A. Precautions
1. Adhere to the equipment manufacturer's instructions during all testing.
  2. Prior to any testing activity or any measurements taken, ensure the test equipment is at room temperature - approximately 70 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set for about 15 minutes or for however long it takes to bring the test equipment to reach room temp).
  3. Fully charge power sources before each day's testing activity
- B. Test Equipment Set Up

1. Set up the tester to perform a full Category 6 test, as a Permanent Link configuration.
2. If the tester has the capability, set the cable type as product specific setting. If not, set as generic Category 6.
3. Set the tester to save the full test results (all test points, graphs, etc.).
4. Save the test results with the associated cable link identifier to match that as specified by customer.
5. Calibrate the test set per the manufacturer's instructions.

C. Acceptable Test Result Measurements

1. Overall Test Results:
  - a. Links which report a Fail, Fail\* or Pass\* for any of the individual tests shall result in an overall link Fail. All individual test results must result in a Pass to achieve an overall Pass.
  - b. Any reconfiguration of link components required as a result of a test Fail, must be re-tested for conformance.
  - c. Remove and replace any cabling links failing to meet the criteria described in this specification, at no cost to the Owner, with cables that prove, in testing, to meet the minimum requirements.
2. Wire Map: Correctly terminate all pairs of the cabling link at both ends. Provide only continuous pairs. No exceptions.
3. Length: Ninety-four meters is the maximum acceptable electrical length measurements for any cabling link measured under a Permanent Link configuration, including test cords.
4. Insertion Loss: The acceptable insertion loss measurements for any Category 6 cabling link is that which is no greater than that listed in ANSI/TIA-568-C.
5. Worst Pair-to-Pair Near End CrossTalk (NEXT) Loss: The acceptable worst pair-to-pair NEXT loss for any Category 6 cable is that which is no greater than that listed in TIA/EIA-568B.2 Addendum 1.
6. Power Sum NEXT Loss: The acceptable power sum PS-NEXT loss for any Category 6 cable is that which is no greater than that as listed in TIA/EIA-568B.2 Addendum 1.
7. Worst Pair-to-Pair ELFEXT and FEXT Loss: The acceptable worst pair-to-pair ELFEXT and loss for any Category 6 cable is that which is no greater than that listed in TIA/EIA-568B.2 Addendum 1.
8. Power Sum ELFEXT and FEXT Loss: The acceptable PS-ELFEXT and loss for any Category 6 cable is that which is no greater than that listed in TIA/EIA-568B.2 Addendum 1.
9. Return Loss: The acceptable return loss measurements for any Category 6 cable is that which is no greater than that listed in TIA/EIA-568B.2 Addendum 1.
10. Propagation Delay and Delay Skew: The acceptable propagation delay and delay skew measurements for any Category 6 cable is that which is no greater than that listed in TIA/EIA-568B.2 Addendum 1.



### 3.2 RECORDS

- A. Permanently record all test results. Submit test results in a format acceptable to the Owner, or Owner's Representative, or Engineer before system acceptance.
- B. Export all of the numerical test results to a single Microsoft Excel 2000® spreadsheet.
- C. Submit this information at the conclusion of the testing to the Engineer for approval.
- D. Include approved test reports in final record documents submittal.
- E. For each Horizontal Category 6 test, record the following information:
  - 1. Project name and address.
  - 2. Contractor's name.
  - 3. Date of measurement.
  - 4. Ambient temperature.
  - 5. Test equipment, including the following:
    - a. Manufacturer, model, and serial number
    - b. Date and time of last calibration.
  - 6. Operator's name(s).
  - 7. Identification number of cable.
  - 8. Overall test result.

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**SECTION 27 15 00**  
**COMMUNICATIONS HORIZONTAL CABLING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Horizontal Cabling (subsystem of Telecommunications Cabling Infrastructure).
- B. Related Sections
  - 1. Comply with the Related Sections requirements of Section 270511.

**1.2 REFERENCES**

- A. Comply with the Reference requirements of Section 270511.

**1.3 DEFINITIONS**

- A. In addition, define the following list of terms as used in this specification as follows:
  - 1. "CMP": Communications Media Plenum, plenum rating; synonymous with "MPP"
  - 2. "UTP": Unshielded Twisted Pair
  - 3. "CAT6": Category 6 [UTP]
  - 4. "FEP": Fluorinated Ethylene Propylene
  - 5. "PVC": PolyVinyl Chloride
  - 6. "Permanent Link": Test configuration for a horizontal cabling link excluding test cords, connections at the ends of the test cords, patch cords, equipment cords, line cords; e.g., the 'permanent' portion of the horizontal cabling to each outlet consisting of cable, consolidation point (if used), termination/connecting apparatus in the IDF and the connector at the outlet.
  - 7. "Channel": End to end transmission path; e.g., the entire portion of the horizontal cabling to each outlet consisting of the Permanent Link, line cord (at the workstation), patch cord, and, if a full crossconnection is implemented, the crossconnect termination/connecting apparatus and equipment cord.

**1.4 SYSTEM DESCRIPTION**

- A. Work Covered Under Other Sections
  - 1. Pathways: The communications pathways (conduits, stubs, etc.) are existing and work will be covered under another Section. Refer to the Drawings for size/capacity information.
  - 2. Rooms: Telecommunications Room and accompanying equipment is existing. Refer to the Drawings for existing conditions.
- B. Base Bid Work

1. Provide engineering, labor, materials, apparatus, tools, equipment, and transportation required to make a complete working communications Horizontal Twisted Pair Cabling System installation described in this Section and shown on related Drawings. Consider Horizontal Cabling as shown on Drawings as base bid work, unless otherwise noted. This includes terminations at both ends.
2. In general, the base bid work includes:
  - a. Submittals
  - b. Horizontal cables, terminations, and outlets
  - c. Cable management
  - d. Patch cords and cross-connects
  - e. Cable identification tags and system labeling
  - f. Record Documents
  - g. Warranty

#### 1.5 SUBMITTALS

- A. Comply with the Submittals article of Section 270511 for procedural, quantity, content, and format requirements.
- B. Submittal Requirements at Start Of Construction:
  1. Product Data Submittal, indicating conformance with NEC, UL, TIA/EIA listings, certifications and specifications.
  2. Sample Submittal, consisting of the following components:
    - a. Cable Label Sample
  3. Schedule Submittal, consisting of proposed schedule of work. This schedule may be combined with the schedule developed for 27xxxx series Sections.
  4. Shop Drawings Submittal, consisting of proposed changes to cable routing, or termination locations/configurations.
- C. Submittal Requirements at Closeout:
  1. As-Built Drawings
  2. Cable ID -to- Office Number Key: Submit a "cable ID-to-Office number key" as an electronic file in an MS-Excel spreadsheet file format containing a list of every cable identifier associated with the final office number.
  3. Crossconnection records/cut sheets
  4. O & M Manuals
- D. Substitutions
  1. Requests for substitutions shall conform to the general requirements and procedure outlined in Section 270511.

#### 1.6 QUALITY ASSURANCE

- A. Comply with Quality Assurance requirements of Section 270511.
- B. Contractor Qualifications

1. In addition to the Contractor Qualifications requirements of Section 270511, the Contractor shall be manufacturer certified to install the proposed and submitted cabling system and to provide an extended warranty. Provide satisfactory evidence of certification in the form of a current letter or certificate from the manufacturer as part of the bid submission.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with the Delivery, Storage and Handling requirements of Section 270511.

#### **1.8 WARRANTY**

- A. The horizontal cabling system, as specified in this section, shall carry a 20-year (minimum) extended system warranty. This extended warranty shall cover parts and labor for the duration of the extended warranty. This extended warranty shall also cover electrical performance of cabling system to the specific category per ANSI/TIA-568-B performance criteria for horizontal cabling.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. When applicable, product manufacturers must match. For example, cabling and terminations should match. Also termination equipment and apparatus should match.

#### **2.2 HORIZONTAL CABLE - PLENUM RATED**

- A. Category 6 UTP 4-Pair Cable
  1. Application: Suitable for indoor installation, within cable tray and above ceiling.
  2. Conductors:
    - a. Insulated Conductors: 23 AWG solid copper, fully insulated with a flame retardant thermoplastic material (material = PVC, or equivalent).
    - b. Twisted Pairs: Two insulated conductors "twisted" into a "pair" (twisted pair) with individually color-coded twisted pairs to industry standards (ANSI/ICEA Publication S-80-576-1994, and EIA-230).
  3. Cable Sheath:
    - a. Provide unshielded cable with a seamless outer jacket (material = LS-PVC, or equivalent) applied to and completely cover the internal components (twisted pairs).
    - b. Flame Rating: NEC (Article 800) rated as CMP, and UL listed as such.
  4. Electrical Performance: Meet or exceed ANSI/TIA-568-C.1 and ISO/IEC 11801 requirements for CAT6 UTP cabling.

### 2.3 PATCH CORDS AND CROSSCONNECT WIRE

- A. Modular Patch Cords - Type: Data Category 6
  - 1. Modular patch cords suitable for indoor installation within a telecom room or workstation environment.
  - 2. Cords assembled from a single, continuous length of cordage, homogenous in nature, and terminated at both ends via 8 position modular plugs. Splices are not permitted anywhere.
  - 3. Cordage
    - a. Insulated Conductors: 24 AWG stranded copper, fully insulated with a flame retardant thermoplastic material (such as PVC, or equivalent).
    - b. Twisted Pairs: Two insulated conductors "twisted" into a "pair" (twisted pair), and individually color-coded.
    - c. Unshielded sheath and flame-retardant polyvinyl chloride (PVC) jacketed.
    - d. Flame Rating: NEC CM (or higher) rated, and UL listed as such.
  - 4. Electrical Performance: Comply with TIA/EIA-568-B for CAT6 UTP patch cords and Channel requirements (minimum).
- B. Voice Crossconnect Wire
  - 1. Suitable for indoor installation within a 110-based crossconnect system. Each and every crossconnect wire manufactured from a single, continuous length of insulated wire, homogenous in nature (splices are not permitted).
  - 2. Factory splices of insulated conductors are expressly prohibited.
  - 3. Conductors:
    - a. Insulated Conductors: Conductors of 24 AWG solid copper and fully insulated with a flame retardant thermoplastic material (such as PVC, or equivalent).
    - b. Twisted Pairs: Two insulated conductors "twisted" into a "pair" (twisted pair), and individually color-coded.
      - 1) Crossconnect wire, 1 pair, Whi-Red / Red-Whi
      - 2) Crossconnect wire, 1 pair, Whi-Blu / Blu-Whi

### 2.4 TERMINATION EQUIPMENT

- A. Data Category 6 Cabling Modular Patch Panel, Telecommunication Rooms
  - 1. Modular patch panels suitable for installation within a telecommunication facility for the termination of the Horizontal cables.
  - 2. Modular patch panels horizontally oriented for a rack-mounted configuration.
  - 3. Modular patch panels capable of supporting, organizing, labeling and patching/ crossconnecting between the horizontal termination field and the equipment termination field.
  - 4. Modular patch panel having either 110-type termination for the Horizontal cables or discrete jack type, and having 48 ports each.
  - 5. Each port an 8-position modular jack, compliant to TIA/EAI-568-B.2 Chapter 5, and T568B wired.

6. Electrical Performance: Meet or exceed TIA/EIA-568-B requirements for Category 6 UTP cabling.
  - a. Category 6 Modular patch panel, 48 ports.

B. Horizontal Management Panels

1. Application: Suitable for installation into equipment rack for cable routing (back) & cord routing (front). Provide double-sided horizontal management panels (i.e., have management capacity on the front and back). The horizontal management panel shall match (and fully integrate with) the vertical management sections.
2. Size & Capacity: 2U high, with hinged/removable cover and pass through holes.
3. Horizontal management panel, single sided, 2U, black

## 2.5 CONNECTORS

A. Modular Connectors - Category 6 Cabling

1. Modular connectors for Category 6 UTP 4-pair cables that are 8-position modular jacks, compliant to TIA/EIA-568-B.2 Chapter 5, Category 6 rated.
2. Modular connectors that are 568B wired.
  - 1) Category 6 8-position jack, white - Voice
  - 2) Category 6 8-position jack, blue - Data

## 2.6 WORKSTATION OUTLETS

A. Faceplates for Standard Flush-Mount Outlets

1. Faceplates for standard flush-mount outlet shall have six ports.
2. Faceplates that include required accessories, such as icons, blank inserts, labels and label windows.
3. Color: White (confirm with Architect).

B. Faceplate for Wall Phone Outlets

1. Faceplates for wall phone outlets shall have 1 modular jack and two mounting studs.
2. Color: White (confirm with Architect).

## 2.7 LABELS

A. General:

1. Provide labels that are machine printable with a laser printer, ink jet printer, thermal transfer printer, or hand-held printer.

B. Labels for Horizontal Cables

1. Adhesive backed labels and self-laminating feature.
2. Fit the horizontal cables listed above (i.e., shall fully wrap around the cable's jacket).
3. A 2"x.05" printable area minimum, in size and white in color.
  - 1) Labels for cable diameters 0.16"-0.32", white, desktop printer (laser or ink jet)

- C. Labels for Modular Patch Panels
  - 1. Adhesive backed labels.
  - 2. Fit above the port without overlap to the next port or to the port itself.
  - 3. A 0.61" x 0.33" printable area minimum.
    - 1) Labels for patch panels, blue, desktop printer (laser or ink jet)
    - 2) Labels for patch panels, white, desktop printer (laser or ink jet)
- D. Labels for Termination Blocks
  - 1. Color: Blue for horizontal termination field.
    - 1) Label inserts, blue, desktop printer (laser or ink jet)
- E. Labels for Faceplates
  - 1. Labels compatible with the faceplates specified above.
  - 2. Color: White.
    - 1) Label sheet, white, desktop printer (laser or ink jet)

## **2.8 MISCELLANEOUS COMPONENTS**

- A. Velcro Cable Ties
  - 1. Width: .75".
  - 2. Color: Velcro cable ties the same color as the cable to which it is being applied.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Comply with the Execution requirements of Section 270511.

### **3.2 EXAMINATION AND PREPARATION**

- A. Rooms: Prior to installation, verify equipment rooms are suitable to accept the horizontal cables and terminations.
- B. Pathways: Prior to installation, verify that existing pathways and supporting devices are properly installed. Verify dimensions of pathways, including length (for example, "True Tape" the conduits).
- C. Cable Integrity: Prior to installation, verify the twisted pair cable is fully operational - both cable sheath and twisted pair conductors. Documentation of pre-installation testing is not a close out requirement, and is the responsibility of the Contractor.

### **3.3 INSTALLATION**

- A. Horizontal Cable Installation and Routing
  - 1. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.

2. Place cables within designated pathways, such as conduit, cable runway, etc. Do not fasten (such as with cable ties) or attach cables to other building infrastructure (such as ducts, pipes, conduits, etc), other systems (such as ceiling support wires, wall studs, etc), or to the outside of conduits, cable trays, or other non-approved pathway systems.
  3. Place and suspend cables and conductors during installation and termination in a manner to protect them from physical interference or damage. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation or termination at no additional cost.
  4. Maintain maximum cable length of 90 meters from the termination in the IDF to the termination at the work area (permanent link).
  5. Route cables at 90-degree angles, allowing for bending radius, along corridors for ease of access.
  6. Do not exceed manufacturer's limits for pulling tension.
  7. Do not use cable-pulling compounds for indoor installations.
  8. Maintain a minimum bend radius of 6 times the cable diameter during and after installation.
  9. Route cables under building infrastructure (such as ducts, pipes, conduits, etc); Do not route cables over building infrastructure. The installation shall result in easy accessibility to the cables in the future.
  10. Place cables 6", minimum, away from power sources to reduce interference from EMI.
  11. Place a pull string along with cables where run in pathways and spare capacity in the pathway remains. Tie off ends of the pull string (to prevent the string from falling into the conduit).
  12. When exiting the primary pathway (such as basketway or cable tray) to the work area, exit via the top of the pathway. Secure the cables to the pathway using an approved cable tie.
- B. Cable Routing and Dressing within the Telecommunication Room
1. Place cables within the overhead cable support and, when routing vertically, fasten the cables onto wall-mounted vertical cable support every 24 inches on-center using cable ties.
  2. At the rack bay, route cables into the back of the vertical management sections. Divide the cables equally between both sides of an equipment rack such that a cable does not travel past the midpoint of the rack prior to termination.
- C. Termination in the Telecommunication Room
1. Provide termination apparatus and accessories required for a complete installation. Install and assemble termination apparatus, accessories and associated management apparatus according to the manufacturer's instructions.
  2. Properly strain relieve cables to and at termination points per manufacturer's instructions.
  3. Terminate cables and twisted pairs in accordance with manufacturer's latest installation requirements and ANSI/TIA-568-C.1 standard installation practices. Terminate cable pairs onto the termination apparatus. Terminate twisted pairs compliant to T568B wiring, per ANSI/TIA-568-C.1.



4. Modular Patch Panels and Horizontal Management Panels
    - a. Provide quantity of modular patch panels to support termination of cables served from respective IDF. Provide quantity of horizontal management panels based on the quantity of patch panels.
    - b. Install and assemble modular patch panels and horizontal management panels according to the manufacturer's instructions.
    - c. Install the patch panels and the horizontal management panels as shown on the Drawings. If configuration is not shown, install the patch panels in association with the horizontal management panels such that a management panel is mounted above and below given patch panel.
  5. Termination Sequence
    - a. Terminate the cables in sequential order using the link's identifier starting at the top left and completing a panel before moving to the next panel below.
- D. Termination at the Work Areas
1. Provide device components, connectors, and accessories required for a complete installation. Install and assemble connectors, jacks, adapters, termination apparatus, accessories and associated management apparatus according to the manufacturer's instructions.
  2. Provide six inches, minimum, sheathed cable slack behind each workstation outlet faceplate. Coil the slack cable inside the raceway, within the wall, or in the junction box (if used), per the cabling manufacturer's installation standards.
  3. Install devices at heights shown on the Drawings.
  4. Mount faceplates plumb, square, and at the same level as adjacent device faceplates.
  5. Patch gaps around faceplates so that faceplate covers the entire opening.
- E. Perform post-installation testing as described in the Telecommunication Testing specification (refer to Section 270811). Replace terminations and connectors not passing the required media test.
- F. Patching and Crossconnecting
1. In IDFs, provide one modular patch cord per complement/device; install between the network switch and the horizontal field. Neatly dress patch cords within the horizontal and vertical management components. Store cord slack within the vertical management section.
  2. In IDFs, provide one 1-pair crossconnect to length from pair #1 per voice link from the horizontal voice termination field to an available pair on the backbone voice termination field. Neatly route the crossconnect wire within the horizontal and vertical management components. Splices in crossconnect wire are prohibited. Color:
    - a. For digital handsets, provide: White-Blue / Blue-White
    - b. For analog handsets, provide: White-Red / Red-White

3. Record crossconnections to backbone cabling for MDF crossconnection purposes and for record documents.

### 3.4 LABELING

#### A. General Requirements

1. Labeling, identifier assignment, and label colors shall conform to TIA/EIA-606-A Administration Standard and as approved by the Owner or Owner's Representative before installation.
2. Permanent labels with machine-generated text (hand written labels will not be accepted).

#### B. Label Formats

1. Horizontal Cable Labels
  - a. Text Attributes: Black, 1/8" high, minimum, or #12 font size.
  - b. Install labels on both ends of cables no more than 4" from the edge of the cable jacket. Install labels such that they are visible by a technician from a normal stance.
2. Patch Panel Labels
  - a. Use modular patch panel labels included in the product packaging. Request approval by the Engineer for other labels.
  - b. Use a label color for the respective field type, per TIA/EIA-606.
  - c. Text Attributes: Black, 3/32" high, minimum, or #10 font size.
3. 110 Termination Block Labels
  - a. Use 110 Termination block labels included in the product packaging. Request approval by the Engineer for other labels.
  - b. Use a label color for the respective field type, per TIA/EIA-606.
  - c. Text Attributes: Black, 3/32" high, minimum, or #10 font size.
4. Outlet Labels
  - a. Use outlet labels included in the product packaging. Request approval by the Engineer for other labels.
  - b. Label Background: White.
  - c. Text Attributes: Black, 1/8" high, minimum, or #12 font size.
  - d. Install label in the top label window. Leave the bottom label window blank.

#### C. Identifier Assignment

1. General: Separate label fields of the identifier with a hyphen.
2. Horizontal Cables
  - a. First field: the originating Telecommunication Room identity; for example: "2.1".
  - b. Second field: the destination room number; for example: "207".
  - c. Third field: the cable's intended service type followed by a unique sequential number; for example: "V1" (voice, cable #1) or "D2" (data, cable #2).
  - d. Fourth field: the cable type; for example: "CAT6".
  - e. Example: "2.1-207-D2-CAT6"

3. Outlets
  - a. First field: the originating IDF room identity; for example: "2.1".
  - b. Second field: the destination room number; for example: "207".
  - c. Third field: a unique sequential number; for example: "01".
  - d. Example: "2.1-207-01"
4. Individual Ports at the Outlets
  - a. First field: the cable's intended service type followed by a unique sequential number; for example: "V1" (voice, cable #1) or "D2" (data, cable #2).
5. Individual Termination Positions at the 110 Termination Blocks
  - a. First field: the End User Room Number; for example: "207".
  - b. Second field: the cable's intended service type followed by a unique sequential number; for example: "V1" (voice, cable #1).
  - c. Example: "207-V1"
6. Individual Ports at the Modular Patch Panels
  - a. First field: the End User Room Number; for example: "207".
  - b. Second field: the cable's intended service type - for example: "D" (data), and a unique sequential number - for example: "2"
  - c. Example: "207-D2"

### 3.5 FINAL INSPECTION AND CERTIFICATION

- A. Punch the Work of this Section compliant to the requirements of Section 270511.
- B. Remove and replace with new, at no cost to the Owner, cables or conductors failing to meet the indicated standards and not passing the testing requirements of Section 270811. The Owner, or Owner's Representative, will not accept the installation until testing has indicated a 100% availability of all cables and conductors or the Owner or Owner's Representative has approved any deviation from this requirement.
- C. Comply with system acceptance and certification requirements of Section 270511

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**SECTION 27 51 16**  
**PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: An overhead voice paging system that utilizes inputs from the phone system.
- B. Related Sections
  - 1. Comply with the Related Sections paragraph of Section 270511.

**1.2 REFERENCES**

- A. Comply with the References requirements of Section 270511.
- B. In addition to those codes, standards, etc., list in Section 270511, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
  - 1. Federal Communications Commission (FCC)
  - 2. FCC Regulation Part 15 - Radio Frequency Devices and Radiation Limits
  - 3. UL Underwriters Laboratories
  - 4. NEMA National Electrical Manufacturers Association
  - 5. ETL Electrical Testing Laboratories
  - 6. ISO International Standards Organization
  - 7. Sound Systems Engineering, 2nd Ed., Davis and Davis, Howard W. Sams Co., 1987.
  - 8. National Electrical Code
  - 9. National, state, local and any other binding building and fire codes
  - 10. Underwriters Laboratories (UL): Applicable listing and ratings
  - 11. American Society for Testing Materials (ASTM)
  - 12. American National Standards Institute (ANSI)
  - 13. Electronic Industries Association (EIA)
  - 14. Telecommunications Industries Association (TIA)

**1.3 DEFINITIONS**

- A. Definitions as described in Section 270511 shall apply to this section.
- B. Section Includes:
  - 1. Supply and install a turnkey paging system, to include equipment and materials, whether specifically mentioned herein or not, to ensure a complete and operating system.
  - 2. Generate submittal information for the complete fabrication, installation and wiring of the system. Provide installation and

wiring, and provide on-site supervision and coordination during implementation.

3. Provide for the initial adjustment of the systems as herein prescribed and provide test equipment for the system checkout and acceptance tests. Prior to the systems acceptance tests submit an initial testing and tuning report showing methods and results for tests performed.
4. Provide a one year warranty for systems installed.

#### **1.4 SYSTEM DESCRIPTION**

##### **A. Overview**

1. Paging System within re-modeled dialysis area will re-use existing paging amplifiers and require installation of new overhead paging speakers and speaker cabling and is integral to fire annunciator system.

##### **B. Base Bid Work**

1. Provide engineering, labor, materials, apparatus, tools, equipment, and transportation required to make a complete working voice paging system as described in this Section and shown on related drawings. Include cabling and equipment as shown on drawings as base bid work, unless otherwise noted.
2. Refer to the related Drawings for additional information.
3. In general, the base bid work includes:
  - a. Submittals
  - b. Cable identification tags and system labeling
  - c. Testing
  - d. Record Documents
  - e. Warranty

##### **C. Coordination**

1. Telecom Coordination: Coordinate the installation with the Telecom Contractor, including use of pathways.

#### **1.5 SUBMITTALS**

##### **A. Comply with the Submittal Requirements of Section 270511.**

##### **B. Quantity: Furnish quantities of each submittal as noted in Section 270511.**

##### **C. Submittal Requirements at Start of Construction:**

1. Product Data Submittal, including cables
2. Shop drawings showing system design and locations

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- ##### **A.**
- Bear costs of shipping to the site, and of unusual storage requirements. Make appropriate arrangements, and coordinate with authorized personnel at the site, for the proper acceptance, handling, protection, and storage of equipment so delivered.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM SPEAKERS:**

#### **A. Ceiling Cone-Type:**

1. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
2. Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.
3. Minimum Dispersion Angle: 100 degrees.
4. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
5. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.
6. Baffle: For flush speakers, minimum thickness of 0.032-inch aluminum with textured white finish. Completely fill the baffle with fiberglass.
7. Vandal-Proof, High-Strength Baffle: For flush-mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi, 0.025-inch minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.
8. Size: 8 inches with 1-inch voice coil and minimum 5-oz. ceramic magnet.
9. Have a minimum of two (2) safety wires installed to a solid surface or use a flexible conduit from ceiling / wall back box to the speaker back box.
10. The speakers and mounting shall be self contained and wall mounted with flush back box at a minimum of 10 meter intervals and shall match (or contrast with, at the direction of the RE) the color of the adjacent surfaces.
11. Provide one spare speaker, mount, and back box for each 50 speakers or portion thereof.

### **2.2 CABLES**

- #### **A. Plenum-rated distributed loudspeaker speaker cable.**

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- #### **A. Verify that pathway and infrastructure requirements are in place as shown on the drawings.**

### **3.2 INSTALLATION**

- #### **A. General: Include the delivery, unloading, setting in place, fastening to walls, floors, ceilings, counters, or other structures where required, interconnecting wiring of the system components, equipment alignment and adjustment, and other work, whether or not expressly**

required, which is necessary to result in complete operational systems.

B. Physical Installation:

1. Firmly secure equipment in place unless requirements of portability dictate otherwise.
2. Provide adequate support for fastenings and supports with a safety load factor of at least three.
3. Secure plumb and square boxes, equipment, etc.

C. Cable Installation:

1. Label cables, with permanent, machine generated number or letter cable markers within six inches of both ends. There shall be no unmarked cables in the system. Marking codes used on cables shall correspond to codes shown on drawings and/or run sheets.
2. Group cables according to the signals being carried. In order to reduce signal contamination, form separate groups for the following cables:
  - a. Control cables
  - b. Loudspeaker audio cables
3. Provide a service loop of appropriate length within racks and at boxes or points of termination.
4. Install no cable with a bend radius less than that recommended by the cable manufacturer.

### 3.3 FIELD QUALITY CONTROL

A. Initial Tests and Measurements: Before final adjusting and acceptance tests are scheduled, perform system checkout. Furnish required test equipment and perform work necessary to determine and/or modify performance of the system to meet the requirements of this specification. Include the following:

1. Test audio systems for compliance with the functional requirements and Performance Standards.
2. Adjust, balance, and align equipment for optimum quality and to meet the manufacturer's published specifications.
3. Prepare and maintain documentation of performance tests, including numerical values of established equipment settings, for reference during the System Acceptance Tests. Submit final results prior to scheduling Final Acceptance Tests Manual.

B. Audio System:

1. Loudspeaker-Line Impedance: Measure the impedance at 250 Hz, 1 kHz, and 4 kHz and the resistance of each loudspeaker line leaving the sound equipment rack with the line disconnected from its normal driving source. For lines to full-range distributed loudspeaker systems, measure the magnitude of impedance at 1 kHz.
2. Power-Output and Signal-Level Adjustment within System:
  - a. Measure the electrical distortion of the overall system for each line-level input channel.
3. Audio Test Signal Paths: Verify operation from source inputs through mixers, etc., to signal destinations.

#### 3.4 SYSTEM ACCEPTANCE TESTS

- A. System acceptance tests shall not be performed until the initial system checkout and the initial testing and tuning report has been completed by the Contractor. The system acceptance tests consist of the following:
1. Demonstrate the operation of system equipment.
  2. Provide final, "as-built" drawings, run sheets, manuals, and other required documents, as detailed in Part 1.

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