

**Veterans Affairs Medical Center  
Tennessee Valley Health Care System  
Nashville Campus  
Nashville, TN**

**Renovate 2G/Palliative Care  
Bathrooms**

VA Project No. 626-14-501

12/11/2013

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**SECTION 00851**  
**LIST OF DRAWINGS**

The drawings listed below accompanying this specification form a part of the contract.

<u>Drawing No.</u>	<u>Title</u>
G-001	COVER SHEET
G-002	GENERAL INFORMATION
A-101	PARTIAL 2 <sup>nd</sup> FLOOR PLAN - DEMOLITION & NEW WORK PLAN
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P-301	PLUMBING DETAILS
E-101	ELECTRICAL PARTIAL 2 <sup>nd</sup> FLOOR PLAN - DEMOLITION & NEW WORK PLAN

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**SECTION 01010**  
**GENERAL REQUIREMENTS**

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**SECTION 01010**  
**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 Renovate 2G/Palliative Care Bathrooms as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.
- C. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the COR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the COR.
- 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 designated "competent person" (CP) (29 CFR 1926.20(b)(2) will maintain a presence at the work site whenever the general or subcontractors are present.
- F. Training:
  - 1. All employees of general contractor or subcontractors shall have the 10-hour or 30-hour OSHA Construction Safety course and other relevant competency training, as

determined by

COR acting as the Construction Safety Officer with input from the facility Construction Safety Committee.

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

G. VHA Directive 2011-36, Safety and Health during Construction, dated 9/22/2011 in its entirety is made a part of this section

H. Manifestly Necessary Requirement: Omissions from the Drawings or Specifications or the misdescription of details of work which are manifestly necessary to carry the intent of the Drawings and Specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work, but shall be performed as if fully and correctly set forth and described in the Drawings and Specifications.

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

A. Base Bid: Work includes general construction, alterations, mechanical and electrical work, necessary removal of existing equipment, structures and construction and certain other items as indicated on the drawings and within the specifications. Work shall be separated into four phases. Each phase consists of renovating a single bathroom at a time. Contract Duration: 80 days Construction. All submittals must be approved and all materials onsite prior to beginning construction.

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

A. Contractor shall reproduce specifications and Drawings provided on [www.fbo.gov](http://www.fbo.gov).

#### **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.

B. Security Procedures:

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3 days notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the COR for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.
2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. Coordinate with COR.



D. 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.  

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s information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
  - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.

- b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

#### E. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. On site VA parking is restricted to patients and staff only. No Contractor parking will be permitted in the VA garage or anywhere on site.
3. Contractor can park a vehicle within staging areas (if there's enough room with storage and dumpster; past staging area sizes will NOT increase in the future). If coordinated/approved, Contractor may be allowed to park one vehicle adjacent to its staging area. Contractor can actively drop-off / pickup personnel and materials, but cannot park illegally when doing so and should not leave a vehicle unattended. Contractor actively working out of a vehicle (on-board welder, pressure washer, waste catch, etc.) will have to coordinate these provisions / allowances in advance with its COR.
4. Contractor discovered to be parking illegally will be reported to VA Police and may be ticketed and/or asked to leave the property.

### 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 Project Engineer and Facility Safety Officer for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 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, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the COR 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 Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COR and facility Safety Manager

G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR and facility Safety Manager.

H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

J. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with COR and facility Safety Manager. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the COR.ILSM measures must be implemented in

the event that any of these systems are required to be taken down to perform construction. Refer to attached "ILSM Check Sheet" at the end of this section.

- K. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR and facility Safety Manager. The contractor shall coordinate and implement necessary "Interim Life Safety Measures" (ILSM) with the COR. Refer to attached "ILSM Check Sheet" at the end of this section.
- L. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR. Obtain permits from facility Safety Manager at least 24 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work. Refer to "Burn Permit" at the end of this section.
- M. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR and facility Safety Manager.
- N. 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.
- O. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- P. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- Q. The COTR and contractor will complete the Interim Life Safety Measures (ILSM) Check Sheet attached to this section. When project work makes it necessary, the Safety Officer will assist in initiating ILSM necessary to maintain life safety before the project starts.

## **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 COR.
- Contractors shall provide their own staging area fencing (7' minimum) that includes screening fabric, insure fence is properly anchored (to the pavement or ground) to prevent fence from blowing over. Contractor shall provide the name of the project construction company on the exterior of the staging areas fencing. Location of sign shall be coordinated with the

COR.

- Smoking shall not be permitted in staging areas. Contractor shall post No Smoking signs in staging area.
- Contractors shall insure any stored material is on pallets, covered to protect from weather or stored in Conex Containers or Trailers. All conduit and piping material stored in exterior staging areas shall be covered at all times. Bulk and Large material will be exempt from this requirement if approved by the COR.
- Contractor shall not lean material against the Medical Center exterior walls or fencing.
- Contractor shall keep the staging area gates locked, except when moving material in/out of staging area.
- Flammable material shall not be stored near Medical Center exterior walls.
- Contractor shall cut grass inside their staging area and trim along the outside of their staging area fence.

E. Workmen are subject to rules of Medical Center applicable to their conduct.

F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.
2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to

Medical Center areas required to remain in operation.

3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.

G. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.

H. Phasing: To insure such executions, Contractor shall furnish the COR with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such phasing dates to insure accomplishment of this work in successive phases mutually agreeable to Medical Center Director, COR and Contractor, as follows:

**Phase I:** First Bathroom.

**Phase II:** Second Bathroom.

**Phase III:** Third Bathroom.

**Phase IV:** Fourth Bathroom.

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



such indication, where directed by COR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director's prior knowledge and written approval. Refer to specification Sections 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL) for additional requirements.
  2. Contractor shall submit a request to interrupt any such services to COR, in writing, 72 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
  3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
  4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
  5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
  6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- J. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
  2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.
- K. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.
- L. Contractor shall perform work between 7:00 am - 4:30pm Monday through Friday. No work shall be performed on federal VA holidays. In order to accomplish tasks and meet deadlines, permission to work (no extra cost allowed) at times other than those specified above will be granted/denied at the Resident Engineer's discretion upon request. Work during off hours will be required in order to minimize disruptions. Conduct work on floor below and floor above after hours and on weekends. Temperature dependent work shall be done during mild weather of the Spring or Fall. Provide Fire Watch personnel during Fire Protection or Fire Alarm outages. Heavy vibration work shall be after normal duty hours. Work outside of construction limits shall be done outside of normal duty hours or on the weekends.

## **1.7 ALTERATIONS**

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR and a representative of VA Supply Service, of buildings areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by all three, to the 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 building.

2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
  3. Shall note any discrepancies between drawings and existing conditions at site.
  4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR 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 COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:
1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.
- D. Protection: Provide the following protective measures:
1. Wherever existing roof surfaces are disturbed they shall be

protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.

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

#### **1.8 INFECTION PREVENTION MEASURES**

- A. Obtain PICRA Permit and implement the requirements of VAMC's Preconstruction Infection Control Risk Assessment (PICRA) team. PICRA 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. Medical Center's PICRA policy can be found later in this section.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group as specified here. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to Resident Project Engineer and Facility ICRA team for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- C. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically

during the construction stage to determine impact of construction activities on indoor air quality. In addition:

1. The COR and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.
  2. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.
- D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by COR. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
  2. Do not perform dust producing tasks within occupied areas without the approval of the COR. For construction in any areas that will remain jointly occupied by the medical Center and Contractor's workers, the Contractor shall:
    - a. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (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.

- b. 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. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
- c. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
- d. The contractor shall not haul debris through patient-care areas without prior approval of the COR and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
- e. 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.
- f. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.

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

E. Final Cleanup:

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

**1.9 DISPOSAL AND RETENTION**

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
  - 1. Reserved items which are to remain property of the Government are identified by attached tags 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 where directed by COR.
  - 2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center
  - 3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract

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

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

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the 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 FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. 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 apparent low bidder, 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
- 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 COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

### **1.12 PHYSICAL DATA**

- A. Data and information furnished or referred to below is for the

Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by VA engineering.

**(FAR 52.236-4)**

Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

**1.13 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. 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)**

**1.14 AS-BUILT DRAWINGS**

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

**1.15 USE OF ROADWAYS**

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

#### **1.16 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT**

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
1. Permission to use each unit or system must be given by COR. If the equipment is not installed and maintained in accordance with the following provisions, the COR will withdraw permission for use of the equipment.
  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.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

#### **1.17 TEMPORARY USE OF EXISTING ELEVATORS**

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

- proper condition. Contractor may use elevators designated by the COR and for special nonrecurring time intervals when permission is granted. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.
2. Contractor covers and provides maximum protection of following elevator components:
    - a. Entrance jambs, heads soffits and threshold plates.
    - b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
    - c. Finish flooring.
  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.

#### **1.18 TEMPORARY TOILETS**

- A. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workmen.

Failure to maintain satisfactory condition in toilets will  
deprive Contractor of the privilege to use such toilets.

#### **1.19 AVAILABILITY AND USE OF UTILITY SERVICES**

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
  - 1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- E. Water (for Construction and Testing): Furnish temporary water service.
  - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow

preventer at each connection. Water is available at no cost to the Contractor.

2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR's discretion) of use of water from Medical Center's system.

#### **1.20 TESTS**

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the 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, feedwater, condensate and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.



- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

#### **1.21 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 (four copies each) for each separate piece of equipment shall be delivered to the COR 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. 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 COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

#### **1.22 PHOTOGRAPHIC DOCUMENTATION**

- A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones including electronic indexing, navigation, storage and remote access to the documentation, as per these specifications.
- B. Photographic documentation elements:
  - 1. Each digital image shall be taken with a professional grade camera with minimum size of 6 megapixels (MP) capable of producing 200x250mm (8 x 10 inch) prints with a minimum of 2272 x 1704 pixels and 400x500mm (16 x 20 inch) prints with a minimum 2592 x 1944 pixels.
  - 2. Indexing and navigation system shall utilize actual AUTOCAD construction drawings, making such drawings interactive on an on-line interface. For all documentation referenced herein, indexing and navigation must be organized by both time (date- stamped) and location throughout the project.
  - 3. As-built condition of pre-slab utilities and site utilities

shall be documented prior to pouring slabs, placing concrete and/or backfilling. This process shall include all underground and in-slab utilities within the building(s) envelope(s) and utility runs in the immediate vicinity of the building(s) envelope(s). This may also include utilities enclosed in slab-on-deck in multi-story buildings. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive site utility plans.

4. As-built conditions of mechanical, electrical, plumbing and all other systems shall be documented post-inspection and pre-insulation, sheet rock or dry wall installation. This process shall include all finished systems located in the walls and ceilings of all buildings at the Project. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.

- C. Upon completion of the project, final copies of the documentation (the "Permanent Record") with the indexing and navigation system embedded (and active) shall be provided in an electronic media format, typically a DVD or external hard-drive. Permanent Record shall have Building Information Modeling (BIM) interface capabilities. On-line access terminates upon delivery of the Permanent Record.

#### **1.23 EQUIPMENT ID FOR VA OWNED EQUIPMENT**

- A. During the demolition phase of this project, the Contractor will be required to remove and turn over to the COR all existing "Building Service Equipment" cards (marked with an EE number or a Bldg Service Equip number on a Label) and their jackets that are scheduled to be replaced or removed.
- B. The Contractor shall complete all new equipment cards to be on all new equipment installed under this project. A Blank equipment card is included at the end of this section.
- C. The Contractor shall complete this information and turnover the

card before the new equipment is accepted (before final inspection). After the equipment cards have been completed on each new equipment item, the Contractor shall verify with the COR compliance and accuracy. If equipment is a direct replacement, the same EE number will be used.

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## Department of Veterans Affairs

**ATTACHMENT A**  
**Memorandum 626-01-EC5-01**

INTERIM LIFE SAFETY MEASURES (ILSM) CHECK SHEET		PROJECT TITLE	PROJECT NO.	COR
<p>The COR for each and every project will complete this ILSM Check Sheet prior to the start of the project. When project work makes it necessary to implement ILSM, the Safety Officer will be informed. The Safety Officer will assist in initiating those ILSM necessary to maintain life safety before the project starts. The COR is responsible for assuring that the project does not start before ILSM are in place. The COR is responsible for conducting daily inspections of the work site.</p>				
1.	Will any exits be obstructed during construction such that alternative exits will have to be established? If yes, then the Safety Officer must provide training to all concerned staff on alternative exiting arrangements.			Yes <input type="checkbox"/> No <input type="checkbox"/>
	Training completed:	Date By		
2.	Will access to emergency services be obstructed so that emergency forces cannot gain access? If yes, then alternate means of access or proper direction for emergency service personnel must be provided.			Yes <input type="checkbox"/> No <input type="checkbox"/>
	Corrections completed:	Date By		
3.	Will any fire alarm, detection, or suppression system be impaired during this project? If yes, then a temporary but equivalent system must be provided. The temporary system must be inspected every day.			Yes <input type="checkbox"/> No <input type="checkbox"/>
	Temporary in place:	Date By		
4.	Will temporary construction partitions be necessary? If yes, then the temporary partitions must be smoke tight and built of non-combustible or limited-combustible materials that will not contribute to the development or spread of fire.			Yes <input type="checkbox"/> No <input type="checkbox"/>
5.	Will additional fire fighting equipment be necessary? If yes, then the COR will assure that the contractor provides construction employees with adequate fire extinguishers and assure that these employees are properly trained in the use of the fire fighting equipment.			Yes <input type="checkbox"/> No <input type="checkbox"/>
6.	Will the level of fire safety that is required by the Life Safety Code be reduced because of exiting deficiencies or other activities due to the construction? If yes then the Safety Officer will initiate a program of conducting two fire drills per shift per quarter in the areas affected by the construction for the duration of the project.			Yes <input type="checkbox"/> No <input type="checkbox"/>
7.	Will structural or compartmentation features of fire safety be compromised? If yes, then the Safety Officer will provide training on alternate fire safety procedures to the personnel of all smoke zones that will be affected.			Yes <input type="checkbox"/> No <input type="checkbox"/>
	Training completed:	Date By		
8.	Will any of the above ILSM need to be implemented? If yes, then In addition to the training and education initiatives, the Safety Officer will initiate a memorandum for the Director's signature addressed to all employees that clarifies the ILSM taken to address any Life Safety Code deficiencies and/or construction hazards that will exist during this project.			Yes <input type="checkbox"/> No <input type="checkbox"/>
	Memorandum initiated:	Date By		
Remarks:				

## Department of Veterans Affairs

## Portable Gas or Arc Equipment Cutting and Welding Permit

### SECTION I

Location of Work (Include project as applicable)		Work to be Performed (Include contractor as applicable)	
Special Precautions Normal fire precautions		Fire Watch Required YES <input type="checkbox"/> NO <input type="checkbox"/>	
Permit Issued By	Date Issued 10/2/13 Month/Day/Year	Date Expires Month/Day/Year	
Inspection Completed By		Permit to be posted at work site and at the Engineering Office. Permit expires on the specified date or upon the completion of the work as indicated. Return completed permit to Engineering Office.	

### SECTION II

Before approval, a VA Engineering Officer shall inspect the work area and confirm that precautions have been taken to prevent fire in accordance with NFPA 51B

#### PRECAUTIONS

- ☐ Sprinklers in service  
☐ Cutting and welding equipment is in good repair

#### WITHIN 35 FEET OF THE WORKING AREA

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

#### WORK ON WALLS OR CEILINGS

- ☐ Construction and coverings are noncombustible  
☐ Combustibles removed from opposite side of walls

#### WORK ON TANKS, CONTAINERS, DUCTS, ETC.

- ☐ Equipment cleaned of all combustibles  
☐ Containers purged of flammable vapors

#### FIRE WATCH REQUIRED

- ☐ To be provided during and 30 minutes after operation  
☐ Supplied with appropriate charged extinguisher  
☐ Trained in use of equipment and in sounding fire alarm

#### FINAL CHECK-UP

- ☐ To be made 30 minutes after completion of any operation

### SECTION III

Use Reverse Side for Additional Space

Date			Time Started			Time Completed			Supervisor Initial
MONTH	DAY	YEAR		AM	PM		AM	PM	

[illegible]

## Portable Gas or Arc Equipment Cutting and Welding Permit (Hot Work)

1. Both contractor personnel and VA employees will exercise extreme caution and procure a hot work permit to perform any cutting or welding which produces sparks and heat.
2. The appropriate supervisor or Engineering Officer on a project will obtain for issuance to the VA employee and/or contractor this procedure/permit with the proper documentation to be completed. After completion or expiration of the permit, the completed permit will be returned to the Engineering Office for record keeping.
3. No cutting or welding will be permitted in areas other than in the Engineering Shops unless a permit has been procured. The proper procedure requires an inspection of the involved area and an assessment of fire potential in the work area, which has to be done by a VA Engineering Officer.
4. Any open-flame work is to be done during regular business hours. When this is not possible, then a VA Engineering Officer will remain on duty when any burning, welding, soldering, or any open-flame work is being done.  
VA Engineering Officer is typically the Contracting Officers Representative, Safety Engineer, or designee.

## **Construction and Renovation Infection Prevention & Control Precautions**

**1. PURPOSE:** To identify and reduce the risk of acquiring and transmitting infections among patients, employees, physicians and other independent practitioners, contractors, vendors, contract service workers, volunteers, students, visitors, and any other building occupants during hospital renovation or construction activities. Fungal organisms released into the air during these activities can cause illness and even death in people with poor immunity. This memorandum is to be included in the (Green) Safety Manual.

**2. POLICY:** Precautions will be taken to make conditions as safe as possible before and during all construction and renovation to protect the environment from hidden infectious disease hazards which may be released into the air, carried on dust particles or on clothing during construction activities. (For example: Aspergillus species may be found in decaying plaster, drywall, and settled dust found on ceiling tiles and in areas that have been undisturbed for long periods of time.) This applies to all construction and/or renovation managed by Engineering Service, Department of Veterans Affairs Tennessee Valley Healthcare System (VA TVHS) at VA TVHS campuses and facilities, including Community Based Outpatient Clinic's (CBOC) and cemeteries.

### **3. RESPONSIBILITIES:**

a. **Engineering Service and Infection Prevention & Control Team**, will screen future construction/ renovation projects during the project design phase and at the project start for construction activity types. Construction activity types will be defined by the amount of dust that is generated, the duration and extent of the activity, the amount of shared heating and air conditioning systems, and the location of the activity. Personnel will conduct a Pre-Construction Risk Assessment (PCRA) for all construction projects.

b. **Infection Preventionists (IP)** will assist in making recommendations for implementation of safety/infection prevention and control practices for the duration of the job. Precautions taken in specific settings will be agreed upon after corroboration between Infection Prevention, Engineering Service and the service chief of the specific area.

c. **The Immediate Job Supervisor, Superintendent, Foreman (VA or Contractor):** of the construction/renovation will be responsible for insuring that coordinated precautionary measures are properly enacted and maintained throughout the work.

d. **Infection Prevention, Engineering Service and the project Contracting Officer Technical Representative (COR)** will monitor these temporary measures by conducting documented periodic inspections at predetermined intervals during construction/renovation.



e. Environmental Management Service (EMS) will have an integral part in cleaning of the areas immediately adjacent to the site and in certain cases within the work site itself.

f. Engineering/Safety, Infection Prevention, EMS and/or the construction team should be contacted if any regulation is questionable under these guidelines.

#### 4. DEFINITIONS & PRE-CONSTRUCTION ACTIVITIES:

a. Preparation for Construction and Renovation should include the following:

- (1) Patient placement and relocation;
- (2) Standards for barriers and other protective measures required to protect adjacent areas and susceptible patient from airborne contaminants;
- (3) Temporary provisions or phasing for construction or modification of heating, ventilating, air conditioning, and water supply systems;
- (4) Protection of occupied patient areas from demolition;
- (5) Measures to be taken to train healthcare facility staff, visitors, and construction personnel on maintenance of interim life safety and infection control risk mitigation recommendations.

b. **Attachment A** will be used to identify the Type of Construction Project Activity, Patient Risk Group (Low, Medium, High, Highest) and the Class of Precautions (*I, II, III, IV*) or level of infection control activities required.

c. **Attachment B** will be used to monitor Construction Project Activity during the Project. Findings will be reported to the Environment of Care Board through the Safety Manager or Chief Engineer.

#### 5. REFERENCES:

a. Association for Professionals in Infection Control and Epidemiology. *Text of Infection Control and Epidemiology: Construction Renovation*, 3<sup>rd</sup> Edition: Chapter 106:1-18. Washington, DC: APIC, 2009

b. American Lung Association, Environmental Protection Agency, Consumer Product Safety Commissions, American Medical Association. *Indoor Air Pollution: An Introduction for Health Professionals*. Washington, DC: US Government Printing Office, 1994. Publication 523-217/ 81322

c. American Institute of Architects. *Guidelines for Design and Construction of Hospital and Healthcare Facilities*. Washington, DC: AIA Press: 1996

d. Occupational Safety and Health Administration, Legionnaires' disease. In *OSHA Technical Manual* Section II, 1997;7:1-46, U.S. Department of Labor

e. VHA Center for Engineering & Occupational Health and Safety. *Construction Safety Guidebook*. St. Louis, MO. April 2009

**6. RESCISSION:** VA TVHS Memorandum 626-08-138-74

**7. RESPONSIBILITY AND REVIEW DATE:** This memorandum will be reviewed annually by the Chief, Engineering with the assistance of Infection Prevention and Environmental Management Service and will be reissued no later than June 30, 2014.

**/s/ Juan A. Morales, RN, MSN 8/15/2011**

Juan A. Morales, RN, MSN  
Health System Director

Attachments:

A - Pre-Construction Control Risk Assessment (PCRA)  
B - Infection Prevention/ Safety Program, Periodic Construction Rounds Compliance Monitor

**DISTRIBUTION: Green Safety Manual**

### ATTACHMENT A

(Note: To be filled out by Infection Control and Engineering Service during project design and revalidated at the start of construction.)

Pre-Construction Risk Assessment		
Infection Prevention/ Safety Construction Permit		
<b>Location of Construction:</b>	<b>Project Start Date:</b>	
<b>Project Coordinator:</b>	<b>Estimated Duration:</b>	
<b>Contractor Performing Work:</b>	<b>Permit Expiration Date:</b>	
<b>Supervisor:</b>	<b>Telephone:</b>	
Description of project:		
<b>Construction Activities</b>		
<p>The following jobs do not require completion of the Pre-construction risk assessment form on low and medium risk project areas:</p> <ol style="list-style-type: none"> <li>1. Paint and wallpaper in business offices and non-patient areas.</li> <li>2. Paint in empty patient room if closed for painting and less than 3 sq.ft. of wall needs patched. Filter for room unit changed after painting.</li> <li>3. Installation of soap dispenser/needle box/paper towel holder in patient room.</li> <li>4. Repair of window blind.</li> <li>5. Ceiling tile replacement for area less than 5 2 X 2 tiles in a patient area if patient is out of the immediate area and clean up can be accomplished before patient returns.</li> <li>5. Minimum repair of nurse call system/TV/Bed/Telephone.</li> <li>6. Check or replace electric outlet.</li> <li>7. Replace light bulb.</li> <li>8. Unstop sink/commode with no water on floor.</li> <li>9. Unstop commode when water on floor requires maintenance to have Housekeeping clean area immediately.</li> <li>10. Repair medical gas outlet. (Front Body)</li> <li>11. Air balance readings.</li> <li>12. Check air-conditioning.</li> <li>13. Intermediate jobs that create a moderate amount of dust inside room and is made negative by use of hepa-equipped unit with minimum 10 ACH, and all air discharged outside, hepa unit must run 2 hours after completion of job and Housekeeping must clean room before unit is removed from room. All work and use of hepa unit must be documented and copy forward to Infection Control and Safety. <b>NOTE: all duct vents to be sealed off during work!</b></li> </ol> <ul style="list-style-type: none"> <li>• The above does not apply to any Protective Environment patient areas or occupied high and highest risk areas.</li> </ul>		
Yes	No	
		<b>Will there be noise generated that will impact a department adjacent to, above, or below the construction area?</b>
		a. If so, these departments must be notified.
		b. How are you going to reduce the noise to an acceptable level?
Yes	No	
		<b>Will there be vibration generated that will impact a department adjacent to, above, or below the construction area?</b>
		a. If so, these departments must be notified each time this type of work will be performed.
		b. How are you going to reduce the vibration to an acceptable level?
Yes	No	
		<b>Are Emergency Procedures in place and posted on each job for accidental events that could greatly impact Patient Care or Life Safety to the facility? Included in these procedures are such things as:</b>
		<ul style="list-style-type: none"> <li>• Emergency telephone numbers of key departments.</li> <li>• A plan that describes where main valves, switches, and controls are for the area in case of an emergency.</li> <li>• A plan for unexpected outages.</li> </ul>
<b>Environment</b>		
Yes	No	<b>Are any of the following environmental hazards present?</b>
		Will hazardous chemicals be used on this project? How will fumes and odors be controlled? <b>MSDS Sheets are required.</b>
		Is asbestos abatement required on this job? <b>If so, notify Safety and FES at the activation.</b>
		Will there be hot work done on this project? If there are, then a hot work permit must be posted on the job site. All hot work must have a fire watch assigned to each area while the hot work is being performed.
		Will there be a Confined Space Entry required on this project? If so, the Medical Center's confined space entry program must be followed.
<b>Utility Failures</b>		
Yes	No	<b>Will any of the following systems be out of service at any time during the project?</b>
		<ul style="list-style-type: none"> <li>• Fire alarm <b>(If out for more than 4 hours, Interim Life Safety Measures must be implemented.)</b></li> <li>• Sprinkler <b>(If out for more than 4 hours, Interim Life Safety Measures must be implemented.)</b></li> <li>• Electrical</li> <li>• Domestic water</li> <li>• Oxygen</li> <li>• Sewage</li> <li>• H V A C</li> </ul>

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Yes	No	
		<b>Will there be any work that will require activation of the Interim Life Safety Measures during this project? Some things that trigger ILSM's to be implemented are but not limited to:</b> <ul style="list-style-type: none"> <li>Any construction that impacts an EXIT or stairs,</li> <li>Any construction that impacts major breaches in a fire or smoke wall, (<b>penetration permit required</b>)</li> <li>Taking the main fire protection system out of service (sprinkler),</li> <li>Taking the main fire alarm system out of service,</li> <li>Taking the "area" fire or fire alarm systems out of service for more than 4 hours within a 24-hour period.</li> </ul>
		<b>Implementation of the ILSM requires a fire watch and the ILSM forms to be completed (forms are to be obtained from the</b>
		Medical Center Fire Department
<b>Additional Safety Concerns</b>		
Yes	No	
		Will construction affect exit routes from occupied areas adjacent to construction site?
		Will project affect traffic patterns in area? <b><i>If yes, explain plan.</i></b>
		<b>The following must be completed prior to any construction activities.</b>
		<ul style="list-style-type: none"> <li>Separation wall must be constructed prior to project beginning.</li> <li>Fire protection systems must remain intact.</li> <li>Provide extra fire extinguishers in work areas.</li> <li>Maintain exit lights in work area.</li> <li>Maintain negative air in construction area (24/7) through duration of project.</li> <li>There cannot be any return air from within the construction area to the rest of the building.</li> <li>Redirect exiting not to go through construction area.</li> <li>Put signs on doors into construction area "Construction Area – Do Not Enter".</li> <li>Maintain daily logs and keep a current Hot Work Permit.</li> <li>Place tacky mats at doors exiting construction area.</li> <li>All debris removal must be by covered cart.</li> <li>Maintain clean and orderly work area.</li> <li>How will this project affect the departments above, below and adjacent to this project?</li> </ul>
<b>Air Quality and Infection Control</b>		
The construction activity types are defined by the amount of dust that is generated, the duration of the activity, and the amount of shared HVAC systems. Contact CVAMC's Safety Office and Infection Preventionist if any activity is questionable under these guidelines.		
Yes	No	
		Will dust be generated during this project? <b><i>If yes, explain location of and plan for interim dust barriers or attach floor plan with barriers clearly marked.</i></b>
		Will debris removal be necessary? <b><i>If yes, explain plan for debris removal and control.</i></b>
		Negative airflow ventilation and filtration in place and assessed for effectiveness.
		Exhaust fans in place and functioning.
		Is supply duct to area closed and HEPA filtration unit in place and functioning in adjacent patient care area?
		Will work be done in a sterile area? <b><i>If so, how are you going to maintain sterile atmosphere in work area and access to and from work area?</i></b>
<b>Type A Inspections and Non-Invasive Activities or Small scale, Short duration Activities</b>		
Yes	No	
		Removal of ceiling tiles for visual inspection (limited to <25% of total area)
		Painting (limited sanding to <10% of area)
		Wall covering—Describe work to be done:
		Electrical trim work. Describe:
		Minor plumbing. Describe:
<b>Type B Small scale, short duration activities that create minimal dust.</b>		
Yes	No	
		Installation of telephone and computer cabling
		Access to chase spaces
		Sanding of walls for painting or wall covering (minor repairs—not sanding for drywall finishing)

<b>Type C</b>		<b>Any work that generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies.</b>	
Yes	No		
		Sanding of walls-(>50% of surface area)-drywall finishing	
		Removal of <input type="checkbox"/> floor coverings <input type="checkbox"/> ceiling tile <input type="checkbox"/> casework (>50% of surface area) Describe:	
		Cutting of walls or ceiling. Describe:	
		New wall construction	
		Minor ductwork or electrical work above ceilings	
		Major cabling activities	
		Activity cannot be completed within a single work shift	
<b>Type D</b>		<b>Major demolition and construction projects.</b>	
Yes	No		
		Will require heavy demolition or removal of a complete ceiling system	
		New construction	
<b>GROUP 1 LOWEST</b>		<b>GROUP 2 MEDIUM</b>	<b>GROUP 3 HIGH</b>
1.) Office areas 2.) Hallways 3.) EMS		1) Ancillary Therapy areas 2) Respiratory Therapy 3) Outpatient Clinics 4) CBOC's 5) Mental Health Units	1) Pharmacy Areas 2) Radiology 3) Triage 4) Laboratories
			<b>GROUP 4 HIGHEST</b>
			1) CLCs 2) SPD 3) Acute Care Units 4) Bone Marrow Transplant Unit 5) Operating Rooms 6) Chemotherapy areas (outpatient clinics/inpatient) 7) Areas/Units adjacent to BMTU 8) Palliative Care 9) ICU's

Contact the Infection Preventionist or Safety Office for risk assessment of any area not listed above.

<b>CONSTRUCTION ACTIVITY</b> (from previous page) <i>Check type of activity</i>		<b>INFECTION CONTROL RISK GROUP</b> (see above) <i>Check risk group</i>	
	TYPE A: Inspection, non-invasive activity		GROUP 1: Lowest Risk
	TYPE B: Small scale, short duration projects		GROUP 2: Medium Risk
	TYPE C: Activity generates moderate to high levels of dust, requiring >1 work shift for completion		GROUP 3: High Risk
	TYPE D: Major duration and construction activities Requiring consecutive work shifts		GROUP 4: Highest Risk

#### CLASSIFICATION OF REQUIRED PREVENTIVE MEASURES

CONSTRUCTION ACTIVITY- INFECTION CONTROL RISK GROUP	4,	TYP E "A"	TYPE "B"	TYP E "C"	TYP E "D"
Group 1		I	I	II	III/IV
Group 2		I	I	III	IV
Group 3		II	III	III/IV	IV
Group 4		III	III/IV	III/IV	IV

An Infection Control—Safety Construction Permit is required for Class III or higher projects. Refer to shaded area on Construction Activity/Risk Group Matrix (above).

<b>CLASS I</b>	1. Execute work by methods to minimize raising dust from construction operations.	2. Immediately replace any ceiling tile displaced for visual inspection.
<b>CLASS II</b>	1. Provide active means to prevent air-borne dust from dispersing into atmosphere 2. Water mist work surfaces to control dust while cutting. 3. Seal unused doors with duct tape. 4. Block off and seal air vents. 5. Wipe surfaces with disinfectant.	6. Contain construction waste before and during transport in tightly covered containers. 7. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area. 8. Place dust mat at entrance and exit of work area as needed. 9. Remove or isolate HVAC system in areas where work is being performed.

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CLASS III	<ol style="list-style-type: none"> <li>1. Obtain infection control permit before construction begins.</li> <li>2. Isolate HVAC system in area where work is being done to prevent contamination of the duct system.</li> <li>3. Complete all critical barriers before construction begins.</li> <li>4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.</li> <li>5. Contain construction waste before and during transport in tightly covered containers.</li> <li>6. Seal holes, pipes, conduits, etc. appropriately.</li> </ol>	<ol style="list-style-type: none"> <li>7. Place dust mat at entrance and exit of work area. Replace as needed.</li> <li>8. Do not remove barriers from work area until completed project is inspected by Safety and Epidemiology Depts. and thoroughly cleaned.</li> </ol> <p><b>After work is completed:</b></p> <ol style="list-style-type: none"> <li>9. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.</li> <li>10. Remove isolation of HVAC system.</li> </ol>
Class IV	<ol style="list-style-type: none"> <li>1. Obtain infection control permit before construction begins.</li> <li>2. Isolate HVAC system in area where work is being done to prevent contamination of duct system.</li> <li>3. Complete all critical barriers or implement control cube method before construction begins.</li> <li>4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.</li> <li>5. Seal holes, pipes, conduits, and punctures appropriately.</li> <li>6. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site.</li> </ol>	<ol style="list-style-type: none"> <li>7. All personnel entering work site are required to wear shoe covers</li> <li>8. Contain construction waste before and during transport in tightly covered containers. Cover transport receptacles or carts. Tape covering.</li> <li>9. Do not remove barriers from work area until completed project is inspected by Safety and Epidemiology Depts. and thoroughly cleaned.</li> </ol> <p><b>After work is completed:</b></p> <ol style="list-style-type: none"> <li>10. Vacuum work area with HEPA filtered vacuums.</li> <li>11. Wet mop with disinfectant.</li> <li>12. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.</li> <li>13. Remove isolation of HVAC system.</li> </ol>

**Additional concerns for all classes:**

1. Maintain manpower and equipment including dust mops, wet mops, brooms, buckets, and clean wiping rags for cleaning fine dust from floors and adjacent occupied areas.
2. Contain work areas outside of construction barriers, including spaces above ceilings, with full height polyethylene sheet barrier, tightly taped.
3. Clean up dust tracked outside of construction area immediately.
4. Temporary construction barriers and closures above ceiling must be dust tight.
5. Removal of debris must be in covered containers.

**Additional Requirements or Concerns:**

Date:

Date:

Date:

### Attachment B

(Note: Fill out for Class II, III, and IV at interval specified by Infection Prevention on A-1)

Infection Prevention / Safety Program Periodic Construction Rounds Compliance Monitor			
Location:	Observed by:	Review Date:	Review Date:
<b>1. Barriers</b>		<b>Review Time:</b>	<b>Review Time:</b>
a. Construction signs posted for the area		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
b. Doors properly closed and sealed		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
c. Floor area clean, no dust tracked		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>2. Air Handling</b>			
a. All windows closed behind barrier		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
b. Negative air at barrier entrance (Types III & IV)		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
c. HVAC system adjusted/modified (Per Attachment. A-1)		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>3. Project Area</b>			
a. Debris removed in appropriate container		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
b. Dust Control mats: Walk off mats clean & adequate to contain construction dust		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
c. Routine cleaning of trash/waste/debris		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>4. Traffic Control</b>			
a. Restricted to necessary staff only with proper escort and construction workers		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
b. All doors and exits free of debris		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>5. Dress Code</b>			
a. Appropriate for the area		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
b. Required to enter		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
c. Required to leave		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>Comments</b>			

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[illegible]



**SECTION 01050**  
**PROJECT SCHEDULES**  
*(SMALL PROJECTS - DESIGN/BID/BUILD)*

**PART 1- GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 CONTRACTOR'S REPRESENTATIVE:**

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COR).
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.

**1.3 COMPUTER PRODUCED SCHEDULES**

- A. The contractor shall provide to the Department of Veterans Affairs (VA), a computer-produced time/cost schedule.
- B. The contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also be responsible for the accurate and timely submittal of the project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.
- C. The VA will report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette(s), when requested by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project.

**1.4 THE COMPLETE PROJECT SCHEDULE SUBMITTAL**

- A. Within 15 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; electronic pdf copy of the baseline schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include a pdf copy of a

computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the network diagram. The Contracting Officer's separate approval of the Project Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

- D. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.
- E. The Complete Project Schedule shall contain approximately 30 work activities/events.

#### **1.5 WORK ACTIVITY/EVENT COST DATA**

- A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be

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used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.

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

**1.6 PROJECT SCHEDULE REQUIREMENTS**

- A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor Shall:
  - 1. Show activities/events as:
    - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
    - b. COR's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
    - c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
    - d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
    - e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase.
  - 2. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
  - 3. Break up the work into activities/events of a duration no longer than

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10 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 10 work days.

4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
  5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.
- B. The Contractor shall submit the following supporting data in addition to the project schedule:
1. The appropriate project calendar including working days and holidays.
  2. The planned number of shifts per day.
  3. The number of hours per shift.
- Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COR's approval of the Project Schedule.
- D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

**1.7 PAYMENT TO THE CONTRACTOR:**

- A. Monthly, the contractor shall submit the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project

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schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.

- B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

#### **1.8 RESPONSIBILITY FOR COMPLETION**

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

#### **1.9 CHANGES TO THE SCHEDULE**

- A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
  - 1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are

shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.

2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
  3. The schedule does not represent the actual prosecution and progress of the project.
  4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.
- B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.
- C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.
- D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

#### **1.10 ADJUSTMENT OF CONTRACT COMPLETION**

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.

- B. Actual delays in activities/events which, according to the computer-produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.
- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

- - - E N D - - -

**SECTION 01090**  
**REFERENCE STANDARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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)**

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS  
Office of Facilities Management  
Facility Quality Service (181A)  
811 Vermont Avenue, NW - Room 462  
Washington, DC 20420  
Telephone Number: (202) 565-5214  
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)**

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 <a href="http://www.aabchq.com">http://www.aabchq.com</a>
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.acgih.org">http://www.acgih.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>
AWA	American Welding Society, Inc. <a href="http://www.amweld.org">http://www.amweld.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>

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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>
NWDA	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>

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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 01340**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
  - 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, manuals, pictures, nameplate data, and test reports as required.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by COR, and action thereon will be taken by COR on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, COR will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by 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.
- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and COR. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and COR assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only electronically. Samples should be hand delivered to COR. COR assumes no



responsibility for checking quantities or exact numbers included in such submittals.

A. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent electronically and shall contain the list of items, name of Medical Center, name of Contractor, project number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.

1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.

2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.

3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.

B. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the specification shall be tested, at the expense of Contractor, in a commercial laboratory approved by Contracting Officer.

1. Laboratory shall furnish Contracting Officer 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 COR and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.

5. Laboratory test reports shall be sent directly to COR for appropriate action.

6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.

7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.

C. 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.

D. Approved samples will be kept on file by the COR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are

not requested for return by Contractor will be discarded after completion of contract.

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

1. For each drawing required, submit one legible photographic paper or vellum reproducible.
2. Reproducible shall be full size.
3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
7. When work is directly related and involves more than one trade, shop drawings shall be submitted to COR under one cover.

1-10. Samples shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval electronically to COR.

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**SECTION 01582**  
**TEMPORARY INTERIOR SIGNAGE**

**PART 1 GENERAL**

**DESCRIPTION**

This section specifies temporary interior signs.

**PART 2 PRODUCTS**

**2.1 TEMPORARY SIGNS**

- A. Fabricate from 50 Kg (110 pound) mat finish white paper.
- B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.
- C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag. Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.
- D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.
- E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twist tie, leaving 150 mm (6-inch) long free ends.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.
- B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.
- C. Identify room with numbers as designated on floor plans.

**3.2 LOCATION**

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

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**SECTION 01741**  
**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:
  - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 9. Plastics (eg, ABS, PVC).
  - 13. Paint.

**1.2 RELATED WORK**

- A. Section 02050, DEMOLITION.
- B. Section 01010, GENERAL REQUIREMENTS.

**1.3 QUALITY ASSURANCE**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
  - 1. Excess or unusable construction materials.
  - 2. Packaging used for construction products.
  - 3. Poor planning and/or layout.
  - 4. Construction error.
  - 5. Over ordering.

6. Weather damage.
  7. Contamination.
  8. Mishandling.
  9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
  - C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
  - D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
  - E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.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 01340, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
  - 1. Procedures to be used for debris management.
  - 2. Techniques to be used to minimize waste generation.
  - 3. Analysis of the estimated 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.

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**SECTION 02050**  
**DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 RELATED WORK:**

- A. Safety Requirements: Section 01010, GENERAL REQUIREMENTS.
- B. Disconnecting utility services prior to demolition: Section 01010, GENERAL REQUIREMENTS.
- C. Reserved items that are to remain the property of the Government: Section 01010, GENERAL REQUIREMENTS.
- D. Infectious Control: Section 01010, GENERAL REQUIREMENTS, Attachment, INFECTION CONTROL POLICY and INFECTION CONTROL PERMIT.

**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 Section GENERAL CONDITIONS.
- B. Provide safeguards, including warning signs, barricades, temporary fences, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01010, 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. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.
- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum.
- F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
  - 1. No wall or part of wall shall be permitted to fall outwardly from structures.

2. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
  3. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- G. 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 COR. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have COR's approval.
- H. The work shall comply with the requirements of Section 01010, GENERAL REQUIREMENTS, Attachment, INFECTION CONTROL POLICY and INFECTION CONTROL PERMIT.

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

- A. Demolish and remove inside utility service lines shown to be removed.
- B. Remove abandoned inside 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 buildings and structures, including all appurtenances related or connected thereto, as noted below:
  1. As required for installation of new utility service lines.
- 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 COR.

- C. Remove and legally dispose of all materials 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 shall be included as part of the lump sum compensation for the work of this section. Materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

**3.2 CLEAN-UP:**

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to COR. 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.

**3.3 SALVAGE**

- A. Removed and Salvaged Items: Do not store or sell items of salvageable value on site.
1. Clean salvaged items of dirt and demolition debris.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area off-site.
  5. Protect items from damage during transport and storage.

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**SECTION 05500**  
**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
  - 1. Support for Wall and Ceiling Mounted Items: (12, 14A, 14C)
  - 2. Loose Lintels
  - 3. Shelf Angles
  - 4. Trap Doors with Ceiling Hatch
  - 5. Modular Channel units for support of medical equipment

**1.2 RELATED WORK**

- A. Prime and finish painting: Section 09900, PAINTING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings:
  - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
  - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
  - 3. Provide templates and rough-in measurements as required.
- C. Manufacturer's Certificates:
  - 1. Anodized finish as specified.
  - 2. Live load designs as specified.
- D. Design Calculations for specified live loads including dead loads.
- E. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

**1.4 QUALITY ASSURANCE**

- A. Each manufactured 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 product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.

- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

#### 1.5 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):  
B18.6.1-81(R97).....Wood Screws  
B18.2.2-87(R93).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):  
A36/A36M-04.....Structural Steel  
A53-02.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated  
Welded and Seamless  
A123-02.....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products  
A307-03.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile  
Strength  
A391/A391M-01.....Grade 80 Alloy Steel Chain  
A653/A653M-04.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-  
Iron Alloy Coated (Galvannealed) by the Hot-Dip  
Process  
A786/A786M-00.....Rolled Steel Floor Plate  
B632-02.....Aluminum-Alloy Rolled Tread Plate  
C1107-02.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)  
F436-03.....Hardened Steel Washers  
F468-03.....Nonferrous Bolts, Hex Cap Screws, and Studs for  
General Use  
F1667-03.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):  
D1.1-04.....Structural Welding Code Steel  
D1.3-98.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)  
12 - 1985.....Pipe Railing Manual  
AMP 500-505-1988.....Metal Finishes Manual
- F. Structural Steel Painting Council (SSPC):  
SP 1-82.....No. 1, Solvent Cleaning  
SP 2-82.....No. 2, Hand Tool Cleaning  
SP 3-82.....No. 3, Power Tool Cleaning
- G. Federal Specifications (Fed. Spec):  
RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid



## **PART 2 - PRODUCTS**

### **2.1 DESIGN CRITERIA**

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Ladders and Rungs: 120 kg (250 pounds) at any point.
- C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.
- D. Modular Channel Units (CV LABS 1, 2, and 3):
  - 1. Position rails perpendicular to path of travel of medical equipment and on centers as required by manufacturer of medical equipment. Position rails to allow continuous attachment along any point on rail.
  - 2. Design system such that deflection will not exceed  $1/720^{\text{th}}$  of span in any plane.
  - 3. Design support structure such that standard modular 24" ceiling fixtures and equipment may be used.
  - 4. Design system to support either a concentrated load of 1,500 pounds at any single point along the exposed rails or the maximum that will be encountered by positioning the equipment at extremities of its travel (maximum load configuration), whichever is greater.
  - 5. Design the system with a factor of safety of 3 based on ultimate strength under static loading conditions.

### **2.2 MATERIALS**

- A. Structural Steel: ASTM A36.
- B. Steel Pipe: ASTM A53.
  - 1. Galvanized for exterior locations.
  - 2. Type S, Grade A unless specified otherwise.
  - 3. NPS (inside diameter) as shown.
- C. Primer Paint: As specified in Section 09900, PAINTING.
- D. Modular Channel Units ASTM A570 GR33:
  - 1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
    - a. Fittings - ASTM A575
    - b. Framing Nuts - ASTM A675 GR50 (material only)
    - c. Screws - ASTM A307
  - 2. Form channel with in turned pyramid shaped clamping ridges on each side.
  - 3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be

- given a quarter turn so as to engage the channel clamping ridges.  
Provide each nut with a spring designed to hold the nut in place.
4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
  5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.
  6. Modular Channel Unit:
    - a. Struts: 12 Gauge hot-rolled steel, ASTM A570 GR 33
    - b. Connectors: Gauge hot-rolled steel, ASTM A575
    - c. Reinforcing Members: Channel shape, ¼" thick hot-rolled steel, AISI C-1008; ¾" thick hot-rolled steel, AISI C-1008; pickled and oiled.
    - d. Medical Equipment Support Grid Bolts: SAE Grade 5 steel with ½" - 13 NC-2 thread and a 5/8" diameter shoulder.
    - e. Medical Equipment Support Grid Nuts: ½" - 12 NC-2 threads, mild steel.

K. Grout: ASTM C1107, pourable type.

## **2.3 HARDWARE**

### **A. Rough Hardware:**

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

### **B. Fasteners:**

1. Powder Actuated Drive Pins: Ed. Spec. FF-P-395, style to suite material.
2. Expansion Bolts (Shields): Fed. Spec. FF-B-588, Group II, Type 1 or type 2. Lead, fiber, and plastic shields are not acceptable. Furnish with bolts or screws.
3. Toggle Bolts: Fed. Spec. FF-B-588, Type I, Class A, Style 1, wire wings are not acceptable.
4. Bolts with Nuts:
  - a. ASME B18.2.2.
  - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
  - c. ASTM F468 for nonferrous bolts.
5. Screws: ASME B18.6.1.
6. Washers: ASTM F436, type to suit material and anchorage.

7. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

## **2.4 FABRICATION GENERAL**

### **A. Material**

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

### **B. Size:**

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

### **C. Connections**

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

### **D. Fasteners and Anchors**

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.

4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:

- a. Fabricate items to design shown.
- b. Furnish members in longest lengths commercially available within the limits shown and specified.
- c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
- d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
- e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
- f. Prepare members for the installation and fitting of hardware.
- g. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.

2. Welding:

- a. Weld in accordance with AWS.
- b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
- c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
- d. Finish welded joints to match finish of adjacent surface.

3. Joining:

- a. Miter or butt members at corners.
- b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.

4. Anchors:

- a. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.

5. Cutting and Fitting:

- a. Accurately cut, machine and fit joints, corners, copes, and miters.

- b. Fit removable members to be easily removed.
  - c. Design and construct field connections in the most practical place for appearance and ease of installation.
  - d. Fit pieces together as required.
  - e. Fabricate connections for ease of assembly and disassembly without use of special tools.
  - f. Joints firm when assembled.
  - g. Conceal joining, fitting and welding on exposed work as far as practical.
  - h. Do not show rivets and screws prominently on the exposed face.
  - i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.
- F. Finish:
- 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
  - 2. Steel and Iron: NAAMM AMP 504.
    - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
    - b. Surfaces exposed in the finished work:
      - 1) Finish smooth rough surfaces and remove projections.
      - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
    - c. Shop Prime Painting:
      - 1) Surfaces of Ferrous metal:
        - a) Items not specified to have other coatings.
        - b) Galvanized surfaces specified to have prime paint.
        - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
        - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
        - e) After cleaning and finishing apply one coat of primer as specified in Section PAINTING.
      - 2) Non ferrous metals: Comply with MAAMM-500 series.
- G. Protection:
- 1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.

2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

## **2.5 SUPPORTS**

### **A. General:**

1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

### **B. For Wall Mounted Items:**

1. For items supported by metal stud partitions.
2. Steel strip minimum of 1.5 mm (0.0598 inch) thick.
3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
4. Steel hat channels where shown. Flange cut and flattened for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.

### **C. For Operating Room Light:**

1. Fabricate as shown to suit equipment furnished.
2. Drill leveling plate for light fixture bolts.

## **2.6 FRAMES**

### **A. Frames for Lead Lined Doors:**

1. Obtain accurate dimensions and templates from suppliers of lead lined doors, finish hardware, and hollow steel door frames.
2. Fabricate as shown for use in connection with lead lined doors.
3. Deliver assembled frames with removable shipping spreaders at top and bottom.
4. Extend angles at jambs from floor to structural slab above. At floors of interstitial spaces, terminate jamb sections and provide anchors as shown.
5. Continuously weld plates and reinforcements to frame members and head members of angle frames between jambs.
6. Weld strap anchors, not over 600 mm (24 inches) on centers, to the back of angles for embedment in masonry or concrete unless shown otherwise.

### **7. Type 15 Door Frames:**

- a. Structural steel angle frames with plate or bar full height to heads. Extend reinforcing at hinge cutouts two inches beyond cutout.
- b. Fabricate top anchorage to beam side at mid height.

- c. Weld clip angles to both legs of angle at top and bottom.
- d. Drill clips and plates, at top and bottom for anchoring jamb angles with two 9 mm (3/8 inch) expansion bolts at each location.
- e. Cut rabbet for pivot hinges and lock strike.

## **2.7 LOOSE LINTELS**

- A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
- B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.
- C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.
  - 1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
  - 2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- E. Provide bearing plates for lintels where shown.
- F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.
- G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.
- H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.

## **2.8 SHELF ANGLES**

- A. Fabricate from steel angles of size shown.
- B. Fabricate angles with horizontal slotted holes for 19 mm (3/4 inch) bolts spaced at not over 900 mm (3 feet) on centers and within 300 mm (12 inches) of ends.
- C. Provide adjustable malleable iron inserts for embedded in concrete framing.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
  - 1. Provide temporary bracing for such items until concrete or masonry is set.

2. Place in accordance with setting drawings and instructions.
3. Build strap anchors, into masonry as work progresses.
- C. Field weld in accordance with AWS.
  1. Design and finish as specified for shop welding.
  2. Use continuous weld unless specified otherwise.
- D. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.
- E. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- F. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.
- G. Secure escutcheon plate with set screw.

### **3.2 INSTALLATION OF SUPPORTS**

- A. Anchorage to structure.
  1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
  2. Secure supports to concrete inserts by bolting or continuous welding as shown.
  3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
  4. Secure steel plate or hat channels to studs as detailed.
- B. Supports for Wall Mounted items:
  1. Locate center of support at anchorage point of supported item.
  2. Locate support at top and bottom of wall hung cabinets.
  3. Locate support at top of floor cabinets and shelving installed against walls.
  4. Locate supports where required for items shown.
- C. Support at Ceiling for X-ray Tube Stand and Radiographic Equipment:
  1. Bolt modular steel channel frames to hangers as shown, anchored to structure above.
  2. Fasten frames with modular channel manufacturers fittings, bolts, and nuts. Space modular channel supports and hangers as shown and as required to suit equipment furnished.
  3. Install closure plates in channels at ceiling where channel opening is visible. Coordinate and cut plates to fit tight against equipment anchors after equipment anchors are installed.
- D. Ceiling Support for Operating Light:



1. Anchor support to structure above as shown.
  2. Set leveling plate as shown level with ceiling.
  3. Secure operating light to leveling plate in accordance with light manufacturer's requirements.
- machine bolts or welds.

### **3.3 FRAMES FOR LEAD LINED DOORS**

- A. Secure jamb angle clips and plates, at top and bottom with two, 9 mm (3/8 inch) expansion bolts to concrete.
- B. Secure 150 x 90 x 13 mm (6 x 3-1/2 x 1/2 inch) angle to steel framing for anchorage when expansion bolts to concrete is not possible.
- C. Secure clips by welding to steel.
- D. At interstitial spaces, anchor jamb angles as shown.

### **3.4 OTHER FRAMES**

- A. Set frame flush with surface unless shown otherwise.
- B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.
- C. Set in formwork before concrete is placed.

### **3.5 STEEL LINTELS**

- A. Use lintel sizes and combinations shown or specified.
- B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.
- C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

### **3.6 SHELF ANGLES**

- A. Anchor shelf angles with 19 mm (3/4 inch) bolts unless shown otherwise in adjustable malleable iron inserts, set level at elevation shown.
- B. Provide expansion space at end of members.

### **3.7 LADDERS**

- A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.
- B. Ladder Rungs:
  1. Set ladder rungs into formwork before concrete is placed. Build ladder rungs into masonry as the work progresses.
  2. Set step portion of rung 150 mm (6 inches) from wall.
  3. Space rungs approximately 300 mm (12 inches) on centers.
  4. Where only one rung is required, locate it 400 mm (16 inches) above the floor.

### **3.8 CLEAN AND ADJUSTING**

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.
- C. Painting: All metal fabrication other than stainless steel, aluminum, and copper shall be painted in accordance with Section 09900 Painting. Steel joints, welded or bolted shall be filed and de-burred prior to painting. Welded joints shall be treated with an approved rust inhibitor prior to painting.

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**SECTION 07270  
FIRESTOPPING SYSTEMS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. Sealants and application: Section 07920, SEALANTS AND CAULKING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- 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**

Firestopping work subject to the terms of the Article "Warranty of Construction" of Section GENERAL CONDITIONS, except extend the warranty period to five years.

**1.6 QUALITY ASSURANCE**

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

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

- B. American Society for Testing and Materials (ASTM):

E84-01.....Surface Burning Characteristics of Building  
Materials

E814-02.....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

1479-00.....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 outgassing 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.
- I. All fire stopping material shall be "Red" in color.

## **2.2 SMOKE STOPPING IN SMOKE PARTITIONS**

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

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

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.

Renovate 2G/Palliative Care Bathrooms  
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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 COTR.
- C. Clean up spills of liquid type materials.

- - - E N D - - -

**SECTION 07920  
SEALANTS AND CAULKING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section covers non-yellowing 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 07270, FIRESTOPPING SYSTEMS.
- C. Sound rated gypsum partitions/sound sealants: Section 09260, GYPSUM BOARD SYSTEMS.
- D. Mechanical Work: Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

**1.3 QUALITY CONTROL:**

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. 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. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
  - 1. Locate test joints where indicated or, if not indicated, as directed by Contracting Officer.
  - 2. Conduct field tests for each application indicated below:

- a. Each type of elastomeric sealant and joint substrate indicated.
- b. Each type of non-elastomeric sealant and joint substrate indicated.
- 3. Notify COTR seven days in advance of dates and times when test joints will be erected.
- 4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
- E. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution:
  - 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this section.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- 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.

**1.5 PROJECT CONDITIONS:**

- A. Environmental Limitations:
  - 1. Do not proceed with installation of joint sealants under following conditions:
    - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 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.



**1.6 DELIVERY, HANDLING, AND STORAGE:**

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 5 °C (90 °F) or less than 32 °C (40 °F).

**1.7 DEFINITIONS:**

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

**1.8 WARRANTY:**

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction" Article specified in Section 01001, GENERAL CONDITIONS, 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 Society for Testing and Materials (ASTM):
  - C612-00.....Mineral Fiber Block and Board Thermal Insulation.
  - C834-00.....Latex Sealants.
  - C920-02.....Elastomeric Joint Sealants.
  - C1330-02.....Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
  - D1056-00.....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-1:

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

B. S-2:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade P.
5. Shore A hardness of 25-40.

C. S-3:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-25.
6. Minimum elongation of 700 percent.

D. S-4:

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

E. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.
6. Minimum elongation of 1200 percent.

F. S-7:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.

5. Shore A hardness of 25-30.
6. Structural glazing application.

G. 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 as selected by COTR from manufacturer's standard range.
- D. Caulking shall be as selected by COTR from manufacturer's standard range.

**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 POUROUS SURFACES:**

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent 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 printer 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. Provide closed or open cell as recommended by each caulking and sealant manufacturer.
- 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 degrees C and 38 degrees C (40 and 100 degrees F).
2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printer instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool joints to concave surface unless shown or specified otherwise.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

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

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

1. Apply a 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 FIELD QUALITY CONTROL:**

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
  - 1. Extent of Testing: Test completed elastomeric sealant joints as follows:
    - a. Perform 10 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
    - b. Perform one test for each 300 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:
  - 1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
  - 2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
  - 3. Whether sealants filled joint cavities and are free from voids.
  - 4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### **3.7 CLEANING:**

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

### 3.8 LOCATIONS:

- A. Exterior Building Joints, Horizontal and Vertical:
  - 1. Metal to Metal: Type S-1, S-2
  - 2. Metal to Masonry or Stone: Type S-1
  - 3. Masonry to Masonry or Stone: Type S-1
  - 4. Stone to Stone: Type S-1
  - 5. Cast Stone to Cast Stone: Type S-1
  - 6. Threshold Setting Bed: Type S-1, S-3, S-4
  - 7. Masonry Expansion and Control Joints: Type S-6
  - 8. Wood to Masonry: Type S-1
- B. Metal Reglets and Flashings:
  - 1. Flashings to Wall: Type S-6
  - 2. Metal to Metal: Type S-6
- C. Sanitary Joints:
  - 1. Walls to Plumbing Fixtures: Type S-9
  - 2. Counter Tops to Walls: Type S-9
  - 3. Pipe Penetrations: Type S-9
- D. High Temperature Joints over 204 degrees C (400 degrees F):
  - 1. Exhaust Pipes, Flues, Breech Stacks: Type S-7.
- E. Interior Caulking:
  - 1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Type C-1, C-2.
  - 2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Type C-1, C-2.
  - 3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Type C-1, C-2.
  - 4. Perimeter of Lead Faced Control Windows and Plaster or Gypsum Wallboard Walls: Type C-1, C-2.
  - 5. Exposed Isolation Joints at Top of Full Height Walls: Type C-1, C-2.
  - 6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2
  - 7. Concealed Acoustic Sealant Type S-4, C-1, C-2.

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**SECTION 09050**  
**INTERIOR/ EXTERIOR FINISHES AND FINISH SCHEDULES**

**PART I - GENERAL**

**1.1 DESCRIPTION**

This section contains requirements for submittals and states that the VA has the right to select premium colors for products if COR deems necessary to meet the intent of the design or in matching existing finishes.

**1.2 MANUFACTURERS**

Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

**1.3 SUBMITTALS**

Submit in accordance with SECTION 01340, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES—provide quadruplicate samples for color approval of materials and finishes specified in this section.

**1.4 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. MASTER PAINTING INSTITUTE: (MPI)

2001.....Architectural Painting Specification Manual

**PART 2- PRODUCTS**

SEE DRAWINGS AND OTHER SPECIFICATIONS SECTIONS.

**PART III EXECUTION**

**3.1 ROOM FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS**

SEE DRAWINGS

--- E N D---

**SECTION 09100  
NON-LOAD BEARING FRAMING SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

A. Support for wall mounted items: Section 05500, METAL FABRICATIONS.

**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.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- 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.

**1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

In accordance with the requirements of ASTM C754.

**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM)
  - A123-02.....Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products

A641-03.....	Zinc-Coated (Galvanized) Carbon Steel Wire
C11-03.....	Terminology Relating to Gypsum and Related Building Materials and Systems
C645-04.....	Non-Structural Steel Framing Members
C754-04.....	Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
C841-03.....	Installation of Interior Lathing and Furring
C954-04.....	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
C1002-04.....	Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

## **PART 2 - PRODUCTS**

### **2.1 PROTECTIVE COATING**

Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G-60 minimum, per ASTM 123.

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

- A. ASTM C645, modified for thickness specified and sizes and shown.
  - 1. Use ASTM A525 steel, 0.9 mm (0.0359-inch) thick bare metal (20 gauge).
  - 2. 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 406 mm (16-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.
- E. Shaft Wall Framing:
  - 1. Conform to rated wall construction.
  - 2. C-H Studs.
  - 3. E Studs.
  - 4. J Runners.

### **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.

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

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- F. Tie Wire and Hanger Wire:
  1. ASTM A641, soft temper, Class 1 coating.
  2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:
  1. 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.
- H. Power Actuated Fasteners:
  1. Fed. Spec. FF-P-395.
  2. Fastener length and Class as required to resist twice the imposed loads; style suitable for type of hanger or bracket used.
  3. Eye Pin: Type I, Class 4, Style EP.
  4. Threaded Stud: Style SC for concrete; Style SS for steel.
  5. Drive Pins: Style PC for concrete, Style PS for steel.
  6. For applications not specified, type and size as recommended by the manufacturer of the material being fastened.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION CRITERIA**

- A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.

- B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

### **3.2 INSTALLING STUDS**

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 406 mm (16 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, shafts, 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 406 mm (16 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, 406 mm (16 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 or "Z" channels:
  - 1. Install rigid (hat section) furring channels at 406 mm (16 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.
- 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.

### **3.5 INSTALLING SHAFT WALL SYSTEM**

- A. Conform to UL Design No. U438 for two-hour fire rating.

- B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 406 mm (16 inches) on center.
- C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.
- D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.
- E. Suitably frame all openings to maintain structural support for wall:
  - 1. Provide necessary liner fillers and shims to conform to label frame requirements.
  - 2. Frame openings cut within a liner panel with E studs around perimeter.
  - 3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

### **3.6 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS**

- A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings or soffits.
  - 1. Space framing at 406 mm (16-inch) centers for gypsum board anchorage.
- B. Existing concrete construction exposed:
  - 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.
- C. 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.

**3.7 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.)

- - - E N D - - -



**SECTION 09260**  
**GYPSON BOARD SYSTEM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies installation and finishing of gypsum board.

**1.2 RELATED WORK**

- A. Installation of steel framing members for walls, partitions, furring, soffits, Section 09100, NON-LOAD BEARING FRAMING SYSTEMS.
- B. Acoustical Sealants: Section 07920, SEALANTS AND CAULKING.

**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 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
  - 1. Corner bead and edge trim.
  - 2. Finishing materials.
  - 3. Laminating adhesive.
  - 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.
  - 3. Typical shaft wall assembly.
  - 4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.
- D. Samples:
  - 1. Cornerbead.
  - 2. Edge trim.
  - 3. Control joints.
- E. Test Results:
  - 1. Fire rating test, each fire rating required for each assembly.
  - 2. Sound rating test.

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

In accordance with the requirements of ASTM C840.

### **1.6 ENVIRONMENTAL CONDITIONS**

In accordance with the requirements of ASTM C840.

### **1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM):
  - C11-04.....Terminology Relating to Gypsum and Related Building Materials and Systems
  - C475-02.....Joint Compound and Joint Tape for Finishing Gypsum Board
  - C840-04.....Application and Finishing of Gypsum Board
  - C954-04.....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
  - C1002-04.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - C1047-04.....Accessories for Gypsum Wallboard and Gypsum Veneer Base
  - C1177-04.....Glass Mat Gypsum Substrate for Use as Sheathing
  - C1396-04.....Gypsum Board
  - E84-04.....Surface Burning Characteristics of Building Materials
  - E497-99.....Installing Sound Isolating Lightweight Partitions
- C. Underwriters Laboratories Inc. (UL):
  - Latest Edition.....Fire Resistance Directory
- D. Inchcape Testing Services (ITS):
  - Latest Editions.....Certification Listings

## **PART 2 - PRODUCTS**

### **2.1 GYPSUM BOARD**

- A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise.
- B. Coreboard or Shaft Wall Liner Panels.
  - 1. ASTM C1396, Type X.

- 2. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.

- C. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.

## **2.2 GYPSUM SHEATHING BOARD**

- A. ASTM C1396, Type X, water-resistant core, 16 mm (5/8 inch) thick.
- B. ASTM C1177, Type X.

## **2.3 BULLET RESISTANT / DAMAGE RESISTANT BOARD**

- A. Bullet Resistant Fiberglass Material, General: The panels shall be made of multiple layers of starch-oil woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets. The production technique and materials used shall provide the controlled internal delamination to permit the encapture of a penetrating projectile.
- B. SECURITY LEVEL: The Bullet Resistant Fiberglass must be UL LISTED RATED FOR LEVEL 3.

## **2.3 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. Wire Mesh: Soft, annealed steel protected by ASTM A 641/A 641M Class I coat of galvanizing; tie wire, 16 gage, 0.063" diameter; hanger wire, 8 gage, 0.162 inch diameter; 1-1/2" hexagonal pattern.

## **2.4 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.

## **2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE**

ASTM C475 and ASTM C840.

## **PART 3 - EXECUTION**

### **3.1 GYPSUM BOARD HEIGHTS**

- A. Extend all layers of gypsum board from floor to underside of structure overhead.

### 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. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- D. Bring gypsum board into contact, but do not force into place.
- E. Ceilings:
  - 1. For single-ply construction, use perpendicular application.
- F. Walls (Except Shaft 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. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
  - 7. 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.
- G. Acoustical or Sound Rated Partitions, Fire and Smoke 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. Follow ASTM E497 for sound rated partitions. STC minimum values as shown.

H. 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 INSTALLING GYPSUM SHEATHING**

- A. Install in accordance with ASTM C840, except as otherwise specified or shown.
- B. Use screws of sufficient length to secure sheathing to framing.
- C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.
- D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.
- E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

**3.4 CAVITY SHAFT WALL**

- A. Coordinate assembly with Section, NON-LOAD BEARING FRAMING SYSTEMS for erection of framing and gypsum board.
- B. Conform to UL Design No. U438.
- C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
  1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
  2. Stagger joints top and bottom in adjacent panels.

D. Gypsum Board:

1. Two hour wall:

- a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
- b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
- c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.

2. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.

3. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.

E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

**3.5 INSTALLING BULLET RESISTANT / DAMAGE RESISTANT BOARD**

- A. Supporting Members: Prior to installing bullet resistive material verify that supports have been installed as required by Contract Documents and the Drawings.
- B. Joints: All joints shall be reinforced by a back-up layer of bullet resistive material. The bullet resistance of the joint, as reinforced, shall be at least equal to that of the panel. Minimum width of reinforcing layer at joint shall be 4", 2" on each panel or a 2" minimum overlap).
- C. Application: Armor shall be installed in accordance with the manufacturer's printed recommendations. Armor panels shall be adhered using an industrial adhesive, mastic, screws or bolts. Method of application shall maintain the bullet resistive rating at junctures with the concrete floor slab, the concrete roof slab, the bullet resistive door frames, the bullet resistive window frames, and all required penetrations.

**3.6 FINISHING OF GYPSUM BOARD**

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 5 finish for all finished areas open to public view.
- 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, and fire 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, and fire rated construction. Sanding is not required of non decorated surfaces.

### 3.7 CONTROL JOINT INSTALLATION

- A. Install control joints consistent with lines of building spaces in locations such as the following:
  1. Where expansion or control joints occur in substrate;
  2. Where ceiling framing or furring changes direction;
  3. Where wings of "L," "U," and "T"-shaped ceiling areas are joined;
  4. Where gypsum board abuts structural elements, such as columns, beams and load bearing wall;
  5. Where gypsum board abuts dissimilar wall, ceiling or soffit finishes by edge trim.
  6. At both corners of door jambs, extending from door head to ceiling.
  7. At both corners of window jambs, extending from window head to ceiling.
  8. Locate control joints according to the following chart

CONSTRUCTION AND LOCATION	MAX. SINGLE DIMENSION	MAX. SINGLE AREA
PARTITION - INTERIOR	30'-0"	
CEILING INTERIOR		
WITH PERIMETER RELIEF	50'-0"	2500 SQ. FT.
WITHOUT PERIMETER RELIEF	30'-0"	900 SQ. FT.
CEILING - EXTERIOR GYPSUM BOARD	30'-0"	900 SQ. FT.

- B. Full height door frames shall be considered equivalent to a control joint.
- C. Provide control joints in fire-resistant construction according to GA 234.

### 3.6 REPAIRS

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.

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- 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 and fire protection equivalent to the fire rated construction.

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**SECTION 09310**  
**CERAMIC TILE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies ceramic tile, thresholds and window stools, and waterproofing membranes for thin-set applications, and crack isolation membranes.

**1.2 RELATED WORK**

A. Sealing of joints where specified: Section 07920 SEALANTS AND CAULKING.

**1.3 SUBMITTALS**

A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.

B. Samples:

1. Base tile, each type, each color, each size.
2. Paver tile, each size, type, color and pattern.
3. Porcelain tile, each type, color, patterns and size.
4. Wall (or wainscot) tile, each color, size and pattern.
5. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.

C. Product Data:

1. Ceramic tile, marked to show each type, size, and shape required.
2. Dry-set Portland cement mortar.
3. Load Bearing Waterproofing/Crack Isolation Flexible, Seamless Membrane
4. Reinforcing tape.
5. Leveling compound.
6. Latex-Portland cement mortar and grout.
7. Slip resistant tile.
8. Waterproofing isolation membrane.
9. Fasteners.
10. Cementitious backer unit.

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. Elastomeric membrane and bond coat.
  - c. Reinforcing tape.

- d. Latex-Portland cement mortar and grout.
- e. Leveling compound.
- f. Waterproof isolation membrane.
- g. Factory mounted tile suitability for application in wet area specified under 2.1, A, 3 with list of successful in-service performance locations.
- h. Cementitious backer unit.

#### **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):
  - A10.20-1988.....Safety Requirements for Ceramic Tile, Terrazzo, and Marble Works
  - A108.1A-1999.....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
  - A108.1B-1999.....Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar
  - A108.1C-1999.....Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar
  - A108.5-1999.....Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
  - A108.10-1999.....Installation of Grout in Tilework
  - A108.13-1999.....Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone
  - A118.1-1999.....Dry-Set Portland Cement Mortar
  - A118.4-1999.....Latex-Portland Cement Mortar
  - A118.6-1999.....Standard Cement Grouts for Tile Installation
  - A118.7-1999.....Polymer Modified Tile Grouts for Tile Installation

- A118.10-1999.....Load Bearing, Bonded, Waterproof Membranes for  
Thin-Set Ceramic Tile and Dimension Stone  
Installation
- A137.1-1988.....Ceramic Tile
- C. American Society For Testing And Materials (ASTM):
- C241-90 (R97).....Abrasion Resistance of Stone Subjected to Foot  
Traffic
- C627-93(1999).....Evaluating Ceramic Floor Tile Installation  
Systems Using the Robinson-Type Floor Tester
- C954-00.....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
- C1002-01.....Steel Self-Piercing Tapping Screws for the  
Application of Panel Products
- C1027-99.....Determining "Visible Abrasion Resistance on  
Glazed Ceramic Tile"
- C1028-96.....Determining the Static Coefficient of Friction  
of Ceramic Tile and Other Like Surfaces by the  
Horizontal Dynamometer Pull Meter Method
- D. Marble Institute of America (MIA): Design Manual III-1999
- E. Tile Council of America, Inc. (TCA):
- 2002.....Handbook for Ceramic Tile Installation

## **PART 2 - PRODUCTS**

### **2.1 TILE**

- A. Refer to drawings for tile schedule.
- B. Comply with ANSI A137.1, Standard Grade, except as modified:
1. Inspection procedures listed under the Appendix of ANSI A137.1.
  2. Abrasion Resistance Classification:
    - a. Tested in accordance with values listed in Table 1, ASTM C 1027.
    - b. Class IV, 6000 revolutions.
  3. Slip Resistant Tile for Floors:
    - a. Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance:
      - 1) Not less than 0.7 (wet condition) for bathing areas.
      - 2) Not less than 0.8 on ramps for wet and dry conditions.
      - 3) Not less than 0.6, except 0.8 on ramps as stated above, for wet and dry conditions for other areas.
    - b. Porcelain Paver Tile: Matte surface finish.

4. 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.
5. Factory-Applied Temporary Protective Coating:
  - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
  - b. Do not coat unexposed tile surfaces.
  - c. Pre-wax tiles set or grouted with latex modified mortars.
- C. Glazed Wall Tile: Cushion edges, glazing.
- D. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, cushion edges.
- E. Trim Shapes:
  1. Conform to applicable requirements of adjoining floor and wall tile.
  2. Use trim shapes sizes conforming to size of adjoining field wall tile including existing spaces unless detailed or specified otherwise.
4. Internal and External Corners:
  - a. Square internal and external corner joints are not acceptable.
  - b. External corners including edges: Use bullnose shapes.
  - c. Internal corners: Use cove shapes.
  - d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
  - e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
  - f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
  - g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.
  - h. For glazed wall tile installed in latex-Portland cement mortar, use cove and surface bullnose shapes as applicable.

### **2.3 SETTING MATERIALS OR BOND COATS**

- A. Conform to TCA Handbook for Ceramic Tile Installation.
- B. Latex-Portland Cement Mortar: ANSI A118.4.

1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A118.4.
2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.
- C. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non sagging, latex-Portland cement mortar complying with ANSI A118.4.
- D. Load Bearing Waterproofing/Crack Isolation Flexible, Seamless Membrane
  1. ICC Evaluation Service Report ESR-2417
  2. IAPMO/Uniform Plumbing Code File No.3524
  3. UL 2818
  4. ANSI A118.10 and A118.12

5. Physical  
Properties:

Physical Property	Test Method	Product must
7-day Hydrostatic Test	ANSI A118.10	Pass
7-day Breaking Strength	ANSI A118.10	265–300 psi (1.8–2.0 MPa)
7-day Water Immersion	ANSI A118.10	95–120 psi (0.7–0.83 MPa)
7-day Shear Bond	ANSI A118.10	200–275 psi (1.4–1.9 MPa)
28-day Shear Strength	ANSI A118.10	214–343 psi (1.5–2.3 MPa)
System Crack Resistance Test	ANSI A118.12.5.4	Pass (High)
Water Vapor Transmission	ASTM E 96–00E1 Procedure B	0.515 grains/h • ft <sup>2</sup> (0.3602 g/h • m <sup>2</sup> )
Water Vapor Permeance	ASTM E 96–00E1 Procedure B	1.247 perms 71.21 (ng/Pa • s • m <sup>2</sup> )
System Performance	ANSI A118.10; ASTM C627; TCA Rating	cycles 1–14 "Extra Heavy"
Potability of Water Applicable to Waterproofing Systems	NBR 12170:2009 (Technical Norm from Brazil)	Pass

- F. Waterproofing Isolation Membrane:
1. Sheet System TCA F122-02.
  2. Composite sheet consisting of ASTM D5109, Type II, Grade I Chlorinated Polyethylene (CM) sheet reinforced on both sides with a non-woven polyester fiber.
  3. Designed for use in wet areas as an isolation and positive waterproofing membranes for thin-set bonding of sheet to substrate and thin-set bonding of ceramic tile or marble to sheet. Suited for both horizontal and vertical applications.
  4. Conform to the following additional physical properties:

Property	Units	Results	Test Method
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Hardness Shore A	Points	70-80	ASTM D2240 (10 Second Reading)
Shrinkage	Percent	5 maximum	ASTM D1204
Brittleness		No crack remains flexible at temperature-37 degrees C (-25 degrees F)	ASTM D2497 13 mm (1/2- inch) Mandrel Bend
Retention of Properties after Heat Aging	Percent of original	80 Tensile 80 Breaking 80 Elongation	ASTM D3045, 90 degrees C (194 degrees F) for 168 hours

5. Manufacturer's standard sheet size with prefabricated or preformed inside and outside corners.
6. Sheet manufacturer's solvent welding liquid or xylene and edge sealant.

#### 2.4 GROUTING MATERIALS

- A. Latex-Portland Cement Grout: ANSI A118.6 color as specified.
  1. Unsanded grout mixture for joints 3.2 mm (1/8 inch) and narrower.
  2. Sanded grout mixture for joints 3.2 mm (1/8 inch) and wider.

#### 2.5 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).
- 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.

#### 2.6 MARBLE THRESHOLDS:

- 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.

## **2.7 WATER**

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

## **2.8 CLEANING COMPOUNDS**

- A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- B. Materials containing acid or caustic material not acceptable.

## **2.9 CEMENTITIOUS BACKER UNITS**

- A. Use in showers or wet areas. 5/8" thick. Thickness shall match adjacent wall thickness.
- B. ANSI A118.9.
- C. Use cementitious backer units in maximum available lengths.
- D. Backer unit meet or exceed the following additional physical properties:

<u>Property</u>	<u>Test Method</u>	<u>Value</u>
Water absorption	ASTM C948	Less than 20 percent by weight

## **2.10 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.

## **2.11 FASTENERS**

- A. 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.
- B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

## **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 oil, grease, wax, and curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
  - 3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.
- B. Patching and Leveling:
  - 1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
  - 2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.



- a. Thickness of compound as required to bring finish tile system to elevation shown.
  - b. Float finish except finish smooth for elastomeric waterproofing.
  - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
- C. Existing Floors and Walls:
  1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.
  2. Remove existing concrete fill or topping to structural slab. Clean and level the substrate for new setting bed and waterproof membrane or cleavage membrane.
  3. Where new tile bases are required to finish flush with plaster above or where they are extensions of similar bases in conjunction with existing floor tiles cut channel in floor slab and expose rough wall construction sufficiently to accommodate new tile base and setting material.

### **3.4 CEMENTITIOUS BACKER UNITS**

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A108.11 except as specified otherwise.
- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a V joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 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. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.
- F. Do not install joint treatment for seven days after installation of cementitious backer unit.
- G. Joint Treatment:
  - 1. Fill horizontal and vertical joints and corners with latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
  - 2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

### **3.5 THRESHOLDS AND STOOLS**

- 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 TCA detail TR611-02.

### **3.6 CERAMIC TILE - GENERAL**

- A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.
- B. Comply with TCA Installation Guidelines
- C. 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 07920, SEALANTS AND CAULKING, 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. 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.
  - c. Make joints in Paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.
11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
  - a. Tile wall installations composed of tiles 200 by 200 mm (8 by 8 inches or larger).

**3.7 THIN SET CERAMIC TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR**

- A. Installation of Tile: ANSI A108.5, except as specified otherwise.
- B. Slope tile work to drains not less than 1 in 100 (1/8 inch per foot).

**3.8 CERAMIC TILE INSTALLED WITH LOAD BEARING WATERPROOFING/CRACK ISOLATION FLEXIBLE, SEAMLESS MEMBRANE**

- A. Surface Preparation: Prepare surfaces as specified in paragraph 3.3
- B. Installation of Load Bearing Waterproofing/Crack Isolation Flexible, Seamless Membrane:
  1. Apply using a paint brush, roller or trowel

2. Surface temperature must be 50 - 90°F (10 - 32°C) during application and for 24 hours after installation. All substrates must be structurally sound, clean and free of dirt, oil, grease, paint, laitance, efflorescence, concrete sealers or curing compounds. Make rough or uneven concrete smooth to a wood float or better finish
3. Do not level with gypsum or asphalt based products.
4. Maximum deviation in plane must not exceed 1/4" in 10 ft (6 mm in 3 m) with no more than 1/16" in 1 ft (1.5 mm in 0.3 m) variation between high spots.
5. Dampen hot, dry surfaces and sweep off excess water—installation may be made on a damp surface.
6. Pre-Treat Cracks & Joints
7. Pre-Treat Coves and Floor/Wall Transitions
8. Pre-Treat Drains
9. Pre-Treat Penetrations
10. Main Applications: Follow Manufacturer's instructions/recommendations
11. Joint Applications: Follow Manufacturer's instructions/recommendations
12. Drains & Penetrations: Follow Manufacturer's instructions/recommendations
13. Testing: Follow Manufacturer's instructions/recommendations
- C. Installation of Tile in Elastomeric Membrane:  
Follow Manufacturer's instructions/recommendations

### **3.9 GROUTING**

- A. Grout Type and Location:
  1. Grout for glazed wall and base tile, paver tile and unglazed tile, latex-Portland cement grout.
- B. Workmanship:
  1. Install and cure grout in accordance with the applicable standard.
  2. Portland Cement grout: ANSI A108.10.

### **3.10 MOVEMENT JOINTS**

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07920, SEALANTS AND CAULKING.
- B. TCA details EJ 171-02.
- C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.
- D. Rake out grout at joints between tile, at toe of base, not less than 6 mm (1/4 inch) deep.

**3.11 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.

**3.12 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.

**3.13 TESTING FINISH FLOOR**

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

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**SECTION 09510**  
**ACOUSTICAL CEILING**

**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:  
as indicated on drawings.

**1.3 SUBMITTAL**

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Samples:
  - 1. Acoustical units, each type, with label indicating conformance to specification requirements, including units specified to match existing.
  - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
  - 1. Ceiling suspension system, each type, showing complete details of installation , including suspension system specified to match existing and upward access system details for concealed grid systems.
  - 2. Acoustical units, each type
- D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

**1.4 DEFINITIONS**

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

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A641/A641M-98.....Zinc-coated (Galvanized) Carbon Steel Wire
  - C634-01.....Standard Terminology Relating to Environmental Acoustics
  - C635-00.....Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
  - C636-96.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

E84-01.....Surface Burning Characteristics of Building  
Materials

E413-87 (R1999).....Classification for Rating Sound Insulation.

E1264-98.....Classification for Acoustical Ceiling Products

## **PART 2- PRODUCTS**

### **2.1 METAL SUSPENSION SYSTEM**

- A. ASTM C635, heavy-duty system, except as otherwise specified.
  - 1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
    - a. Galvanized cold-rolled steel, bonderized.
  - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
- B. Exposed grid suspension system for support of lay-in panels:
  - 1. Exposed grid width not less than 23 mm (15/16 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.

### **2.2 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).

### **2.3 ANCHORS AND INSERTS**

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. 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.

### **2.4 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		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

## 2.5 ACOUSTICAL UNITS

### A. General:

1. ASTM E1264, weighing 3.6 kg/m<sup>2</sup> (3/4 psf) minimum for mineral fiber panels or tile.
2. Class A Flame Spread: ASTM 84
3. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
4. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
5. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces.
6. Lay-in panels: Sizes as shown, with square edges.

### B. Type III Units - Mineral base with painted finish, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick, pattern CE; noted as A1 and A2 on drawings.

### C. Type IV or Type XX Units to match Building Standard- Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick, pattern GH; noted on drawings as A4. Apply over the paint coat on the face of the unit a poly (vinyl) chloride overspray having a flame spread index of 25 or less when tested in accordance with ASTM E84. Clean Room Class 100 rating.

## 2.6 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 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.
- 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.
  - 3. Caulk perimeter wall moldings with color to match ceiling grid. Refer to Section 07920.
- D. Existing ceiling:
  - 1. Where extension of existing ceilings occur, match existing.
  - 2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
  - 3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

#### **3.2 CEILING SUSPENSION SYSTEM INSTALLATION**

- A. General:
  - 1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
  - 2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
  - 3. Support a maximum area of 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. Anchorage to Structure:

1. Concrete:

- a. 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.

C. Direct Hung Suspension System:

1. As illustrated in ASTM C635.
2. Support main runners by hanger wires attached directly to the structure overhead.
3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

D. 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.

### **3.3 ACOUSTICAL UNIT INSTALLATION**

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 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.

### **3.4 CLEAN-UP AND COMPLETION**

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

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**SECTION 09900**  
**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. Shop prime painting of steel and ferrous metals: Divisions 5, 10, 13, 15 and 16 sections.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:  
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample Panels:
  - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
  - 2. Panels to show color: Composition board, 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. Product type and color.
    - c. 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.
  2. Epoxy coating.
  3. Intumescent clear coating or fire retardant paint.

#### **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 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. Master Painters Institute (MPI):
- No. 10-04.....Exterior Latex, Flat (AE)
- No. 45-04.....Interior Primer Sealer
- No. 47-04.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)

- No. 50-04.....Interior Latex Primer Sealer
  - No. 53-04.....Interior Latex, Flat, MPI Gloss Level 1 (LE)
  - No. 54-04.....Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
  - No. 94-04.....Exterior Alkyd, Semi-Gloss (EO)
  - No. 95-04.....Fast Drying Metal Primer
  - No. 114-04.....Interior Latex, Gloss (LE) and (LG)
  - No. 135-04.....Non-Cementitious Galvanized Primer
  - No. 138-04.....Interior High Performance Latex, MPI Gloss Level 2  
(LF)
  - No. 141-04.....Interior High Performance Latex (SG) MPI Gloss  
Level 5
- H. Steel Structures Painting Council (SSPC):
- SSPC SP 1-00.....Solvent Cleaning
  - SSPC SP 2-00.....Hand Tool Cleaning
  - SSPC SP 3-00.....Power Tool Cleaning

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS (AS SPECIFIED ON DRAWINGS)**

- A. Exterior Alkyd Enamel (EO): MPI 9.
- B. Exterior Latex, Flat (AE): MPI 10.
- C. Interior Primer Sealer: MPI 45.
- D. Interior Enamel Undercoat: MPI 47.
- E. Interior Latex Primer Sealer: MPI 50.
- F. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.
- G. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.
- H. Fast Drying Metal Primer: MPI 95.
- I. Interior latex, Gloss (LE) and (LG): MPI 114.
- J. Waterborne Galvanized Primer: MPI 134.
- K. Non-Cementitious Galvanized Primer: MPI 135.
- L. Interior High Performance Latex, MPI Gloss Level 2(LF): MPI 138.
- M. Interior High Performance Latex (SG), MPI Gloss Level 5: MPI 141.
- N. Epoxy Coating, Water Based Catalyzed, Gloss: Catlayzed epoxy resin; 2-component; water thinable epoxy coating; 2.0 mils minimum dry film thickness per coat or as recommended by manufacturer, whichever is greater; 246 g/L (2.04 lbs/gal) VOC's maximum mixed; 35% volume solids minimum mixed; Federal Specification Corssover - TT-C-535.

### **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**

- 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 local, state or district requirements.
  - 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. Comply with the Regional Ozone Transport Commission (OTC) regulations regarding Volatile Organic Content (VOC).

## **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 not paint in direct sunlight or on surfaces that the sun will soon warm.

C. All exposed piping systems shall be painted and labeled in accordance with VA Standards. This includes mechanical piping, domestic water, duct work, electrical conduit, fire alarm, and communication. Each system shall be identified in accordance to that code and Facility standards. Prior to painting and labeling, verify with the COTR on color and identification.

### **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.

C. 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).
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.
- D. 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 plaster or gypsum board.

### **3.3 PAINT PREPARATION**

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix 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 application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COTR.



- 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 COTR, except in spaces sealed from existing occupied spaces.
  - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
  - 2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.
- I. 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.
- D. Metals:
  - 1. Steel and iron: MPI 95 (Fast Drying Metal Primer)
  - 2. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel (EO)).
- E. Gypsum Board:
  - 1. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) in shower and bathrooms.
  - 2. 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 on surfaces specified.
- 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:
    - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.
    - b. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).

C. Gypsum Board (in locations as indicated):

1. Two coats of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)).
2. Epoxy Coating, Water Based Catalyzed, Gloss.

**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 as indicated on the drawings.
- B. 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.
- C. 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. Paint various systems specified in Divisions 2, 15, and 16.
- C. Paint after tests have been completed.

- D. Omit prime coat from factory prime-coated items.
- E. Finish painting of mechanical and electrical equipment is not required when located in roof spaces and furred spaces except on electrical conduit containing feeders 600 volts or more.
- F. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.
- G. Apply paint systems on properly prepared and primed surface as follows:
  - 1. 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 coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE) on finish of insulation on boiler breeching and uptakes inside boiler house, drums, drumheads, oil heaters, feed water heaters, tanks and piping.
    - 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.
  - 2. 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 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 as indicated on the drawings.
  - 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
  - 3. Painting of ferrous metal and galvanized metal.
  - 4. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Prefinished items:
  - a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
  - b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
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.
6. Galvanized metal:
  - a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
  - b. Gas Storage Racks.
  - c. Except where specifically specified to be painted.
7. Metal safety treads and nosings.
8. Gaskets.
9. Structural steel to receive sprayed-on fire proofing.
10. Ceilings, walls, columns in interstitial spaces.
10. Ceilings, walls, and columns in pipe basements.

### 3.12 IDENTITY PAINTING SCHEDULE

- A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.
  1. Legend shall be by stencil applications. For pipe 2" diameter or less use 2" letters. For pipe diameters 2" or larger use 3" letters.
  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 3,000 mm (10 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 - 110 to 413 kPa (20 to 59 psig).
    - c. Low Pressure - 110 kPa (20 psig) and below.
    - d. Add Fuel oil grade numbers.
  6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Blr Feed
A/C Condenser Water Supply	Safety Green		White	A/C Cond Wtr Sup
A/C Condenser Water Return	Safety Green		White	A/C Cond Wtr Ret
Chilled Water Supply		Safety Blue	White	Ch. Wtr Sup
Chilled Water Return		Safety Blue	White	Ch. Wtr Ret
Shop Compressed Air	Safety Yellow		Black	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Safety Orange	Black	H.P. _____*
High Pressure Condensate Return		Gray	Black	H.P. Ret _____*
Medium Pressure Steam		Safety Orange	Black	M. P. Stm _____*
Medium Pressure Condensate Return		Gray	Black	M.P. Ret _____*
Low Pressure Steam		Safety Orange	Black	L.P. Stm _____*

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Low Pressure Condensate Return		Gray	Black	L.P. Ret _____*
High Temperature Water Supply	Safety	Yellow	Black	H. Temp Wtr Sup
High Temperature Water Return	Safety	Yellow	Black	H. Temp Wtr Ret
Hot Water Heating Supply		White	Black	H. W. Htg Sup
Hot Water Heating Return		White	Black	H. W. Htg Ret
Gravity Condensate Return		Gray	Black	Gravity Cond Ret
Pumped Condensate Return		Gray	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade	Safety	Green	White	Fuel Oil-Grade ____*
Boiler Water Sampling		Yellow	Black	Sample
Chemical Feed		Yellow	Black	Chem Feed
Continuous Blow-Down		Yellow	Black	Cont. B D
Pumped Condensate		Black		Pump Cond
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line	Safety	Yellow	Black	Vent
Alkali		Yellow	Black	Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Safety Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Safety Green	Black	H.W. Dom
Return	White	Safety Green	Black	H.W. Dom Ret
Tempered Water	White	Safety Green	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Yellow	Black	Acid Waste
Vent		Yellow	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec

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Oral Evacuation	Green	White	Oral Evac
Fuel Gas	Yellow	Black	Gas
Fire Protection Water			
Sprinkler	Safety Red	White	Auto Spr
Standpipe	Safety Red	White	Stand
Sprinkler	Safety Red	White	Drain
Natural Gas	Safety Yellow	White	Nat. Gas

7. 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, 5000.

8. See Sections for methods of identification, legends, and abbreviations of the following:

a. Medical Gases and vacuum lines: Section 15491, MEDICAL GAS AND VACUUM SYSTEMS.

b. Conduits containing high voltage feeders over 600 volts: Section 16111, CONDUIT SYSTEMS.

B. Fire and Smoke Partitions and Lead-Lined 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" or, "FIRE/SMOKE PARTITION" or, "THE PARTITIONS, THE DOORS AND THE SHIELD OF THIS ROOM HAVE BEEN INSULATED WITH SHEET LEAD OF \_\_\_\_\_ mm THICKNESS PROVIDING A TOTAL LEAD EQUIVALENT PROTECTION OF \_\_\_\_ mm," as applicable.

3. Locate not more than 3000 mm (10 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 red color.

**3.14 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 10800**  
**TOILET AND BATH ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies manufactured items usually used in dressing rooms, toilets, baths, locker rooms and at sinks in related spaces.
- B. Items Specified:
  - 1. Paper towel dispenser (VA furnished, Contractor installed).
  - 2. Toilet tissue dispenser (VA furnished, Contractor installed).
  - 3. Grab Bars.
  - 4. Clothes hooks, robe or coat.
  - 5. Metal framed mirror.
  - 6. Soap dispensers (VA furnished, Contractor installed).
  - 7. Stainless steel shelves.

**1.2 RELATED WORK**

- A. VA provided accessories and installed by GC as noted on drawings.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings:
  - 1. Grab bars, showing design and each different type of anchorage.
- C. 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.
- D. Manufacturer's Certificates:
  - 1. Anodized finish as specified.

**1.4 QUALITY ASSURANCE**

- A. Each product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be assembled to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

**1.5 PACKAGING AND DELIVERY**

- A. Pack accessories individually to protect finish.



- B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.

#### **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. American Society for Testing and Materials (ASTM):
  - A167-99.....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
  - A176-99.....Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
  - A269-02.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - A312/A312M-02.....Seamless and Welded Austenitic Stainless Steel Pipes
  - C1036-01.....Flat Glass
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series.....Metal Finishes Manual
- D. American Welding Society (AWS):
  - D10.4-86 (R2000).....Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing
- E. Federal Specifications (Fed. Specs.):
  - A-A-3002.....Mirrors, Glass
  - FF-S-107C (2).....Screw, Tapping and Drive
  - WW-P-541/8B.....Plumbing Fixtures (Accessories, Land Use) Detail Specification

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Stainless Steel: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
- C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.
- D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.
- E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.
- F. Glass.
  - 1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors

## **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.

## **2.3 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. AA-M32 Mechanical finish, medium satin.
  - 1. Stainless Steel: NAAMM AMP 503, finish number 4.

## **2.4 FABRICATION - GENERAL**

- A. Welding, AWS D10.4.
- B. Grind dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.
- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
- G. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- H. Provide templates and rough-in measurements as required.

## **2.5 GRAB BARS**

- A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.
- B. Fabricate of stainless steel:
  - 1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- C. Concealed mount.
- D. Bars:
  - 1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
    - a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
  - 2. Fabricate in one continuous piece with ends turned toward walls.
  - 3. Continuous weld intermediate support to the grab bar.
- E. Flange for Concealed Mounting:

1. Minimum of 2.65 mm (0.1046 inch) thick, approximately 75 mm (3 inch) diameter by 13 mm (1/2 inch) deep, with provisions for not less than three set screws for securing flange to back plate.
2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.

F. Back Plates:

1. Minimum 2.65 mm (0.1046 inch) thick metal.
2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.

## **2.6 CLOTHES HOOKS-ROBE OR COAT**

- A. Fabricate hook units either of stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to the thickness of the metal, or 3 mm (1/8 inch) minimum radius.
- B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to the wall flange, provided with concealed fastenings.

## **2.7 MIRRORS**

A. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.
3. Designed with offset for ceramic tile.

## **2.8 STAINLESS STEEL SHELVES**

A. Side wall mounted:

1. Fabricate to size and shape shown of 1.2 mm (0.0478 inch) thick sheet.
2. Turn up edges and weld corners closed.
3. Fabricate brackets and weld to shelf. Drill brackets for 6 mm (1/4 inch) anchor bolts.

B. Back wall mounted:

1. Fabricate to size and shape shown of plate and tube.
2. Turn up edges and weld corners of shelf.
3. Weld tube to back plate and shelf, weld back plate to shelf, filler plate to tube, and corners of shelf with continuous welds.
4. Drill back plate for 6 mm (1/4 inch) anchor bolts.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Before starting work notify COTR in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the COTR the exact location of accessories.

### **3.2 INSTALLATION**

- A. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- B. Install accessories plumb and level and securely anchor to substrate.
- C. 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.
- D. 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.
- E. Align mirrors, dispensers and other accessories even and level, when installed in battery.
- F. Install accessories to prevent striking by other moving, items or interference with accessibility.

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**SECTION 13081**  
**SEISMIC RESTRAINT REQUIREMENTS FOR**  
**NONSTRUCTURAL 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. Section 05500 - Metal Fabrications
- B. Section 09100 - Non-Load Bearing Framing Systems
- C. Section 09260 - Gypsum Board Systems
- D. Section 09510 - Acoustical Ceilings
- E. Section 15200 - Noise and Vibration Control
- F. Section 15400 - Plumbing Systems
- G. Section 15450 - Plumbing Fixtures and Trim
- H. Section 16111 - Conduit Systems
- I. Section 16450 - Grounding

J. Section 16510 - Building Lighting

K. Section 16761 - Audio Visual, Nurse Call, and Code One Systems

### **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 COR or COR.
2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

### **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 only, tension and 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):  
Building Code Requirements for Structural Concrete, ACI 318-99.
- C. American Institute of Steel Construction (AISC):  
Load and Resistance Factor Design Specification for Structural Steel in Buildings, Second Edition, 1994.
- D. American Society for Testing and Materials (ASTM):  
A36/A36M-00.....Standard Specification for Carbon Structural Steel.  
A53/A53M-99.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.  
A307-00.....Standard Specification for Carbon Steel Bolts and Studs; 60,000 PSI Tensile Strength.

- A325-00.....Standard Specification for Structural Bolts,  
Steel, Heat Treated, 120/105 Ksi Minimum Tensile  
Strength.
- A325M-00.....Standard Specification for High-Strength Bolts  
for Structural Steel Joints [Metric].
- A490-00.....Standard Specification for Heat-Treated Steel  
Structural Bolts, 150 ksi Minimum Tensile  
Strength.
- A490M-00.....Standard Specification for High-Strength Steel  
Bolts, Classes 10.9 and 10.9.3, for Structural  
Steel Joints [Metric].
- A500-99.....Standard Specification for Cold-Formed Welded  
and Seamless Carbon Steel Structural Tubing in  
Rounds and Shapes.
- A501-98.....Specification for Hot-Formed Welded and Seamless  
Carbon Steel Structural Tubing.
- A615/615M-00.....Standard Specification for Deformed and Plain  
Billet-Steel Bars for Concrete Reinforcement.
- A992/A992M-98.....Standard Specification for Steel for Structural  
Shapes for Use in Building Framing.
- A996/996M-00.....Standard Specification for Rail-Steel and Axel-  
Steel Deformed Bars for Concrete  
Reinforcement.
- E488-96.....Standard Test Method for Strength of Anchors in  
Concrete and Masonry Elements.
- E. California Building Code, Title 24 Part 2, 1998 edition.
- F. International Conference of Building Officials (ICBO):  
Uniform Building Code (UBC), 1997 edition.
- G. National Uniform Seismic Installation Guidelines (NUSIG).
- H. National Institute of Standards and Technology (NIST):  
Standards for Seismic Safety for Existing Federally Owned or Leased  
Buildings, ICSSC RP4, NISTIR 5382, 1994.
- I. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA):  
Seismic Restraint Manual - Guidelines for Mechanical Systems, 1998  
Edition and Addendum.

#### **1.6 SEISMIC FORCES AND RESTRAINTS:**

- A. Provide seismic-force restraints for the items listed in the Seismic  
Lateral Force Schedule on the drawings.



- B. Exceptions: The attachments of the following items need not be considered.
1. Equipment weighing less than 400 pounds supported directly on the floor or roof.
  2. Equipment weighing less than 20 pounds suspended from a roof or floor or hung from a wall.
  3. Furniture; except storage racks, cabinets, and bookcases as specified in Part 3 of this Section.
  4. Temporary or moveable equipment.

## **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,  $f'c = 25$  MPa (3,000 psi)
- B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION, GENERAL:**

- A. The Seismic Lateral Force Schedule on the construction drawings shows the magnitude of seismic forces to be resisted.
- B. 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.
- C. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- D. Construct seismic restraints and anchorage to allow for thermal expansion.
- E. Testing Before Final Inspection:
  1. Test 10-percent of anchors in masonry and concrete per ASTM E488 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 seismic restraints according to one of the following options:
  - 1. Meet requirements of the latest SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems for the prescribed Seismic Hazard Level (SHL) A.
  - 2. Meet the most current requirements of the National Uniform Seismic Installation Guidelines (NUSIG).
  - 3. Where SMACNA or NUSIG requirements are not met completely, submit proposed alternate details and calculations to completely address seismic bracing requirements. For such designs, use the more stringent of the Local Code or the Uniform Building Code requirements.
- D. 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.
- E. 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.
    - c. Except as noted above, meet requirements of either the Local Code or the Uniform Building Code for determining seismic force  $F_p$ , whichever is more stringent.
  - 2. Provide seismic restraints according to one of the following options:
    - a. Meet the criteria listed above, and meet requirements of the latest SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems for the prescribed Seismic Hazard Level (SHL) A

- b. Meet the criteria listed above, and meet the most current requirements of the National Uniform Seismic Installation Guidelines (NUSIG).
  - c. Where SMACNA or NUSIG requirements are not met completely, submit proposed alternate details and calculations to completely address seismic bracing requirements. For such designs use the more stringent of the Local Code or the Uniform Building Code requirements.
- F. 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 1 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 16510.

#### **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.

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- 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.

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**SEISMIC LATERAL FORCE SCHEDULE**

Specification	Item	Lateral Force Coefficient
	<b>DIVISION 5 - METALS</b>	
05500	Metal Fabrications	
	Supports	
	<b>DIVISION 9 - FINISHES</b>	
09100	Non-Load Bearing Framing Systems	
	Within this Section it talks about studs, runners, and clips. The loads and required restraints do not apply to these components but to the entire wall or the entire suspended ceiling system for gypsum board.	
09260	Gypsum Board Systems (NON LOAD BEARING PARTITIONS)	
	(Seismic factor apply to whole system.)	
09510	Acoustical Ceilings See Specification ref. ASTM E580	
	(Seismic factor applies to whole system.)	
	<b>DIVISION 15 - MECHANICAL</b>	
15200	Noise and Vibration Control (Acoustical enclosures in mechanical rooms)	
15400	Plumbing Systems	
	Note: Pipe is differentiated by size, hanger rod length, not by contents. It is not differentiated by steam condensate vs. chilled water, as in this specification Section.	
15450	Plumbing Fixtures and Trim	
	Water closets	
	Urinals	
	Bathtubs	
	Lavatories	
	Sinks and laundry tubs	
	Dispensers, drinking water	
	Shower bath fixture	
	Emergency fixtures	
	Hydrant, host bib and miscellaneous devices	
	<b>DIVISION 16 - ELECTRICAL</b>	

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Specification	Item	Lateral Force Coefficient
16111	Conduit Systems	
16450	Grounding (grounding wires)	
16510	Building lighting, interior Light fixtures - interior	
16655	Radiology Electrical Systems	
16761	Audio Visual, Nurse Call and Code One Systems	

**SECTION 15050**  
**BASIC METHODS AND REQUIREMENTS (MECHANICAL)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Basic methods and requirements for Division 15, MECHANICAL, apply to all sections of Division 15.
- B. Definitions:
  - 1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
  - 2. Option or optional: Contractor's choice of an alternate material or method.

**1.2 RELATED WORK**

- A. Section 01010, GENERAL REQUIREMENTS.
- B. Section 01340, SAMPLES AND SHOP DRAWINGS.
- C. Section 05500, METAL FABRICATIONS.
- D. Section 07270, FIRESTOPPING.
- E. Section 07920, SEALANTS AND CAULKING.
- F. Section 09900, PAINTING.
- G. Section 15200, NOISE AND VIBRATION CONTROL.
- H. Section 15250, INSULATION.
- I. Section 15400, PLUMBING SYSTEMS
- J. Section 15450, PLUMBING FIXTURES & TRIM
- K. Section 16050, BASIC METHODS AND REQUIRMENTS (ELECTRICAL)

**1.3 QUALITY ASSURANCE**

- A. Equipment Vibration Tolerance:
  - 1. The allowable vibration tolerance is specified in Section 15200, NOISE AND VIBRATION CONTROL. Equipment specifications require factory balancing of equipment to this tolerance.
  - 2. After air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.
- B. Products Criteria:
  - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
  - 2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.

3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
  4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
  5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
  6. Asbestos products or equipment or materials containing asbestos shall not be used.
- C. 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.
- D. 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 COR (Contracting Officer's Technical Representative) 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.
- E. Guaranty: Section 01010, GENERAL REQUIREMENTS.
- F. Plumbing Systems: NAPHCC National Standard Plumbing Code.
- G. Supports for sprinkler piping shall be in conformance with NFPA 13.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
  1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the COR.
  2. Submit electric motor data and variable speed drive data with the driven equipment.



3. Equipment and materials identification.
  4. Fire-stopping materials.
  5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
  6. Wall, floor, and ceiling plates.
- C. Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with Section 01010, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
  2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.
- D. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.
- E. Contractor shall complete the maintenance information data for all equipment installed within the scope of Div. 15. Contractor shall verify approval of COR on all Div 15 equipment.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Rubber Manufacturers Association (ANSI/RMA):
- IP-20-2001.....Drives Using Classical V-Belts and Sheaves
  - IP-21-88.....Drives Using Double-V (Hexagonal) Belts
  - IP-22-91.....Drives Using Narrow V-Belts and Sheaves
- C. Air Movement and Control Association (AMCA):
- 410-96.....Recommended Safety Practices for Air Moving Devices
- D. American Society for Testing and Materials (ASTM):
- A36/A36M-2001.....Carbon Structural Steel
  - A575-96.....Steel Bars, Carbon, Merchant Quality, M-Grades R (2002)
  - E84-2003.....Standard Test Method for Burning Characteristics of Building Materials
  - E119-2000.....Standard Test Method for Fire Tests of Building Construction and Materials
- E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
- SP-58-93.....Pipe Hangers and Supports-Materials, Design and Manufacture

SP-69-96.....Pipe Hangers and Supports-Selection and  
Application

F. National Association of Plumbing - Heating - Cooling Contractors  
(NAPHCC):

1996.....National Standard Plumbing Code

G. National Fire Protection Association (NFPA):

90A-02.....Installation of Air Conditioning and Ventilating  
Systems

101-06.....Life Safety Code

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Identification for piping is specified in Section 09900, 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 09900, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, controls, and terminal units.
- C. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.
- D. Valve Tags and Lists:
  - 1. Plumbing: Provide for all valves (Fixture stops not included).
  - 2. HVAC: Provide for all valves other than for equipment in Section 15740, TERMINAL UNITS.
  - 3. 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.
  - 4. Valve lists: Typed or printed plastic coated card(s), sized 216 mm(8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
  - 5. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

### **2.2 FIRESTOPPING**

- A. Section 07270, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and

ductwork. Refer to Section 15250, INSULATION, for firestop pipe and duct insulation.

### **2.3 GALVANIZED REPAIR COMPOUND**

- A. Mil. Spec. DOD-P-21035B, paint form.

### **2.4 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS**

- A. Vibration Isolators: Refer to Section 15200, NOISE AND VIBRATION CONTROL.
- B. In lieu of the paragraphs which follow, suspended equipment support and restraints may be designed and installed in accordance with the National Uniform Seismic Installation Guidelines (NUSIG), most current edition. Submittals based on either the NUSIG guidelines 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. Support of suspended equipment over 227kg (500 pounds) shall be submitted for approval of the COR in all cases. See Section 13081 for lateral force design requirements.
- C. Type Numbers Specified: ANSI Manufacturers Standardization Society (MSS) SP-58. For selection and application refer to MSS SP-69. Refer to Section 05500, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.
- D. 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 (four inches) thick when approved by the COR for each job condition.
  3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the COR for each job condition.
- E. 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 23mm (7/8-inch) outside diameter.
- 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 41mm by 41mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring

held, hardened steel nuts. 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 13mm (1/2-inch) galvanized steel bands, or preinsulated 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 15250, INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated 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. preinsulate
- 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 non adhesive 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. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

2. Plumbing Piping (Other Than General Types):

- a. Horizontal piping: Type 1, 5, 7, 9, and 10.
- b. Chrome plated piping: Chrome plated supports.

- c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
- d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.

## **2.5 PIPE PENETRATIONS**

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
  - 1. For sleeves: Extend sleeve 25 mm (two inch) above finished floor and provide sealant for watertight joint. Fire stop as required.
  - 2. For blocked out floor openings: Provide a concrete curb, minimum 3 inches above finished floor, around opening. Include fire-stopping at penetration to maintain rating.
  - 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration. Include fire-stopping at penetration to maintain rating.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirement must receive prior approval of COR.
- D. Sheet Metal Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
- G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
- H. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight

with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

- I. Sealant and Adhesives: Shall be as specified in Section 07920, SEALANTS AND CAULKING.

## **2.6 TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the COR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the COR.
- D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

## **2.7 WALL, FLOOR AND CEILING PLATES**

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

C. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

D. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01010, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01010, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the COR. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the COR for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After COR's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

E. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear.

F. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance,

equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.

2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

### **3.2 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. Drill or burn holes in structural steel only with the prior approval of the COR.
- B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.
- C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.
- D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-69. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.
- E. Plumbing horizontal and vertical pipe supports, refer to the NAPHCC National Standard Plumbing Code.

### **3.3 LUBRICATION**

- A. Field check and lubricate equipment requiring lubrication prior to initial operation.

### **3.4 STARTUP AND TEMPORARY OPERATION**

- A. Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01010, GENERAL REQUIREMENTS, Article, and TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

### **3.5 OPERATING AND PERFORMANCE TESTS**

- A. Prior to the final inspection, perform required tests as specified in Section 01010, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of



tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

**3.6 INSTRUCTIONS TO VA PERSONNEL**

- A. Provide in accordance with Article, INSTRUCTIONS, of Section 01010, GENERAL REQUIREMENTS.

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**SECTION 15200**  
**NOISE AND VIBRATION CONTROL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Noise criteria, vibration tolerance and vibration isolation for HVAC and plumbing work.

**1.2 RELATED WORK**

- A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL): General mechanical requirements and items, which are common to more than one section of Division 15.

**1.3 QUALITY ASSURANCE**

- A. Refer to article, QUALITY ASSURANCE in specification Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

B. Noise Criteria:

1. Noise levels in all 8 octave bands due to equipment and duct systems shall not exceed following NC levels:

TYPE OF ROOM	NC LEVEL
Bathrooms and Toilet Rooms	40
Conference Rooms	35
Corridors (Nurse Stations)	40
Corridors(Public)	40
Examination Rooms	35
Lobbies, Waiting Areas	40
Offices, Large Open	40
Offices, small private	35

2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the fore-going noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE Fundamentals Handbook 2001, Chapter 7, Sound and Vibration.
3. An allowance, not to exceed 5db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing

material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.

4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

- C. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

#### 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 Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):  
  
2005.....Fundamentals Handbook, Chapter 7, Sound and Vibration
- C. American Society for Testing and Materials (ASTM):  
  
A123/A123M-02.....Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products  
A307-04.....Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength  
D2240-05.....Standard Test Method for Rubber Property - Durometer Hardness
- D. Manufacturers Standardization (MSS):  
  
SP-58-02.....Pipe Hangers and Supports-Materials, Design and Manufacture
- E. Occupational Safety and Health Administration (OSHA):  
  
29 CFR 1910.95.....Occupational Noise Exposure

Renovate 2G/Palliative Care Bathrooms  
VA Project No. 626-14-501

**PART 2 - PRODUCTS**

**2.1 NOT USED.**

**PART 3 - EXECUTION**

**3.1 ADJUSTING**

- A. Adjust damper and valve positions as required to meet room noise criteria.

- - - E N D - - -

**SECTION 15250**  
**INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. Field applied insulation for thermal efficiency and condensation control for

1. HVAC piping, ductwork and equipment.
2. Plumbing piping and equipment.

B. Definitions

1. ASJ: All service jacket, white finish facing or jacket.
2. Air conditioned space: Space directly supplied with heated or cooled air.
3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
4. Concealed: Ductwork and piping above ceilings and in chases and pipe spaces.
5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical, Boiler Plant and electrical equipment rooms or exposed to outdoor weather. Crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, crawl spaces and pipe basements are not considered finished areas.
6. FSK: Foil-scrim-kraft facing.
7. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F); HVAC and plumbing equipment or piping handling media above 41 degrees C (105 degrees F).
8. Density: Kcm - kilograms per cubic meter (Pcf - pounds per cubic foot).
9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
10. Thermal conductance: Heat flow rate through materials.
  - a. Flat surface: Watt per square meter (BTU per hour per square foot).
  - b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).

11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
12. HWH: Hot water heating supply.
13. HWHR: Hot water heating return.
14. HWR: Pump recirculation.
15. CW: Cold water.
16. HW: Hot water.
17. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.
18. RL: Horizontal Rain Leaders and Sump Receivers of Roof Drains.

## **1.2 RELATED WORK**

- A. Section 07270, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
- B. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL): General mechanical requirements and items, which are common to more than one section of Division 15.
- C. Section 15400, PLUMBING SYSTEMS: Hot and cold water piping.

## **1.3 QUALITY ASSURANCE**

- A. Refer to article QUALITY ASSURANCE, in Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Criteria:
  1. Comply with NFPA 90A, particularly paragraphs 2-3.3.1 through 2-3.3.5; 2-3.10.2(a); and 3-4.6.4, parts of which are quoted as follows:
    - a. 2-3.3.1 Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesive, fasteners, tapes and supplementary materials added to air ducts, plenums, panels and duct silencers used in duct systems 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. Where these products are to be applied with adhesive, they shall be tested with such adhesive applied or the adhesive used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state.

- b. Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, Standard for Safety Factory-Made Air Ducts and Air Connectors, shall have been tested and listed in accordance with UL 181A, Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors, or UL 181B, Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors, and used in accordance with the conditions of their listings.

**Exception No. 1:** This requirement shall not apply to air duct weatherproof coverings where they are located entirely outside of a building, do not penetrate a wall or roof, and do not create an exposure hazard.

**Exception No. 2:** Smoke detectors required by 4-4.2.

- c. 2-3.3.2 Air duct, panel and plenum coverings and linings and pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe coverings; 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. In no case shall the test temperature be below 250 degrees F (121 degrees C)
- d. 2-3.3.3 Air duct coverings shall not extend through walls or floors that are required to be fire stopped or required to have a fire resistance rating.

**Exception:** Where such coverings meet the requirements of 3-4.6.4.

- e. 2-3.3.4 Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.
- f. 2-3.3.5 Air duct coverings shall not be installed so as to conceal or prevent the use of any service openings.
- g. "2-3.10.2(a) All materials exposed to the airflow shall be noncombustible or limited combustible and have a maximum smoke developed index of 50.
- h. 3-4.6.4 Where air ducts pass through walls, floors or partitions that are required to have a fire resistance rating and where fire dampers are not required, the opening in the construction around the air duct shall be as follows:
  - 1) Not exceeding a 2.5 cm (1 inch) average clearance on all sides.

- 2) Filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the time-temperature fire conditions required for fire barrier penetration as specified in NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials.

**Exception:** Where fire dampers are installed, proper clearance for expansion shall be maintained.

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.
  5. Listings or Certification from Underwriters Laboratories, Inc., or an equivalent third party testing laboratory will be required to show that surface burning characteristics for materials to continue to adhere to the specified ratings.
- 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 01340, SAMPLE AND SHOP DRAWINGS
- B. Shop Drawings:
  1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
    - a. Insulation materials: Specify each type used and state surface burning characteristics.



- b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
- c. Insulation accessory materials: Each type used.
- d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
- e. Make reference to applicable specification paragraph numbers for coordination.

C. Samples:

- 1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/ blanket; 150 mm (6 inches) long, full diameter for round types.
- 2. Each type of facing and jacket: Minimum size 100 mm (4 inches square).
- 3. Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives / cement / mastic.

**1.5 STORAGE AND HANDLING OF MATERIAL**

Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

**1.6 APPLICABLE PUBLICATIONS**

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

B. Federal Specifications (Fed. Spec.):

L-P-535E-99.....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

C. Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-90.....Adhesives, Fire-Resistant, Thermal Insulation  
MIL-A-24179A -87.....Adhesive, Flexible Unicellular-Plastic  
NOTICE 1.....Thermal Insulation

MIL-C-19565C (1)-88.....Coating Compounds, Thermal Insulation, Fire-and  
Water-Resistant, Vapor-Barrier

MIL-C-20079H-87.....Cloth, Glass; Tape, Textile Glass; and Thread,  
Glass and Wire-Reinforced Glass

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

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

B209-04.....Standard Specification for Aluminum and  
Aluminum-Alloy Sheet and Plate

C411-97.....Standard test method for Hot-Surface Performance  
of High-Temperature Thermal Insulation

C449-00.....Mineral Fiber Hydraulic-Setting Thermal  
Insulating and Finishing Cement

C534-05.....Standard Specification for Preformed Flexible  
Elastomeric Cellular Thermal Insulation in Sheet  
and Tubular Form

C547-06.....Standard Specification for Mineral Fiber pipe  
Insulation

C553-02.....Standard Specification for Mineral Fiber Blanket  
Thermal Insulation for Commercial and Industrial  
Applications

C585-90.....Standard practice for Inner and Outer Diameters  
of Rigid Thermal Insulation for Nominal Sizes of  
Pipe and Tubing (NPS System) R (1998)

C612-04.....Standard Specification for Mineral Fiber Block  
and Board Thermal Insulation

C1136-06.....Standard Specification for Flexible, Low  
Permeance Vapor Retarders for Thermal Insulation

D1668-97a (2006).....Standard Specification for Glass Fabrics (Woven  
and Treated) for Roofing and Waterproofing

E84-06.....Standard Test Method for Surface Burning  
Characteristics of Building  
Materials

E119-05a.....Standard Test Method for Fire Tests of Building  
Construction and Materials

E136-04.....Standard Test Methods for Behavior of Materials  
in a Vertical Tube Furnace at 750 degrees C  
(1380 F)

E. National Fire Protection Association (NFPA):

90A-02.....Installation of Air Conditioning and Ventilating  
Systems

101-06.....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 Value and fitting Industry  
(MSS):

SP58-2002 PIPE HANGERS AND SUPPORTS MATERIALS, DESIGN, AND MANUFACTURE

**PART 2 - PRODUCTS**

**2.1 MINERAL FIBER**

A. ASTM C612 (Board, Block), Class 1 or 2,  $k = 0.037$  Watt per meter, per  
degree C (0.26), external insulation for temperatures up to 204 degrees  
C (400 degrees F).

B. ASTM C553 (Blanket, Flexible) Type I, Class B-3, Density 16 kcm (1 pcf),  
 $k = 0.045$  (0.31) for use at temperatures up to 204 degrees C (400  
degrees F).

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class  
1,  $k = 0.037$  (0.26) for use at temperatures 230 degrees C (450 degrees  
F).

**2.2 FLEXIBLE ELASTOMERIC CELLULAR THERMAL**

A. ASTM C534,  $k = 0.033$  Watt per meter, per degree C (0.27), flame spread  
not over 25, smoke developed not over 100, for temperatures from minus 4  
degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket  
required.

### **2.3. INSULATION FACINGS AND JACKETS**

- A. Vapor Retarder, higher strength with low water permeance  $\leq 0.02$  or less perm rating, Beach puncture 50 units for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.
- B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 5 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 100 mm (4 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. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.
- E. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.
- F. 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.

### **2.4 PIPE COVERING PROTECTION SADDLES**

- A. Cold pipe support: Premolded pipe insulation 80 degrees C (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 kcm (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 80 degrees C (180 degrees F) (half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures upto 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 kcm (3.0 pcf).

## 2.5 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.

## 2.6 MECHANICAL FASTENERS

- A. Pins, anchors: Welded pins, or metal or nylon anchors with tin-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching monel or stainless steel.

- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
- D. Bands: 20 mm (3/4 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

## **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. 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.
- E. 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**

- A. Other than pipe and duct insulation, refer to Section 07270 FIRESTOPPING.

## **2.9 FLAME AND SMOKE**

- A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

## **PART 3 - EXECUTION**

### **3.1 GENERAL REQUIREMENTS**

- A. Required pressure tests of duct and piping joints and connections shall be completed and the work approved by the Contracting Officer's 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 entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate

each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.

- C. Where removal of insulation of piping, ductwork and equipment is required 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 chilled water pumps and heads of chillers, convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- 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. HVAC work not to be insulated:
  - 1. Internally insulated ductwork and air handling units. Omit insulation on relief air ducts (Economizer cycle exhaust air).
  - 2. Exhaust air ducts and plenums, and ventilation exhaust air shafts.
  - 3. Equipment: Hot water pumps.
  - 4. In hot piping: Unions, flexible connectors, control valves, PRVs, safety valves and discharge vent piping. Insulate piping to within approximately 75 mm (3 inches) of uninsulated items.

I. Plumbing work not to be insulated:

1. Piping and valves of fire protection system.
2. Chromium plated brass piping.
3. Medical Gas Piping.
4. Copper Equipment Control Air Piping.

K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

L. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

M. Firestop Pipe and Duct insulation:

1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07270, FIRESTOPPING.
2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
  - a. Pipe risers through mechanical room floors
  - b. Pipe or duct chase walls and floors
  - c. Smoke partitions
  - d. Fire partitions

### **3.2 INSULATION INSTALLATION**

A. Mineral Fiber Board:

1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.



2. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics containing air handling units and duct work exposed to outdoor weather:
  - a. 40 mm (1-1/2 inch) thick insulation faced with ASJ (white all service jacket): Supply air duct.
  - b. 25 mm (1 inch) thick insulation faced with ASJ: Return air duct, mixed air plenums and prefilter housing.
  - c. Outdoor air ducts: 25 mm (one inch) thick insulation faced with ASJ.

B. Flexible Mineral Fiber Blanket:

1. Adhere insulation to metal with 100 mm (4 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from fan discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
3. Concealed supply air ductwork.
  - a. Above ceilings at a roof level: 50 mm (2 inch) thick insulation faced with FSK.
  - b. Above ceilings for other than roof level: 40 mm (1 1/2 inch) thick insulation faced with FSK.
4. Concealed return air duct above ceilings at a roof level and in chases with external wall or containing steam piping; 40 mm (1 1/2 inch) thick, insulation faced with FSK. Concealed return air ductwork in other locations need not be insulated.
5. Concealed outside air duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.

C. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
  - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
  - b. Factory 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 retarder mastic.
  - c. 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 table below, for piping above ground:

Nominal Thickness of Insulation				
Nominal Pipe Size, millimeters (inches):	25 (1) & below	32- 75 (1-1/4- 3)	100-150 (4-6)	200 (8) and above
a. 38-99 degrees C (100-211 degrees F) (HWH, HWHR)	25 (1.0)	40 (1.5)	50 (2.0)	50 (2.0)
1. Runouts to air terminal unit reheat coils	15 (0.5)	-	-	-
b. Domestic cold water and Domestic hot water supply and return	15 (0.5)	20(0.75)	25 (1.0)	40 (1.5)

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**SECTION 15400**  
**PLUMBING SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Domestic water and sewer, including piping, equipment and all necessary accessories as designated in this section.

**1.2 RELATED WORK**

- A. Penetrations in rated enclosures: Section 07270, FIRESTOPPING.
- B. Preparation and finish painting and identification of piping systems: Section 09900, PAINTING.
- C. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- D. Pipe Insulation: Section 15250, INSULATION.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
1. Piping.
  2. Valves.
  3. Cleanouts.
  4. 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. Federal Specifications (Fed. Spec.):
- 0-C-114B(2).....Calcium Hypochlorite, Technical
- 0-S-602E.....Sodium Hypochlorite Solution
- BB-C-120C.....Chlorine, Technical, Liquid
- WW-U-516B.....Unions, Brass or Bronze Threaded, Pipe  
Connections and Solder-Joint Tube Connections
- WW-V-35C.....Valve Ball Brass or Bronze

WW-V-1967 INT AMD 1.....Valve, Butterfly (Threaded Ends And Solder Ends)

C. American National Standards Institute (ANSI):

American Society of Mechanical Engineers (ASME): (Copyrighted Society)

A13.1-81.....Scheme for Identification of Piping Systems

B16.3-92.....Malleable Iron Threaded Fittings ANSI/ASME

B16.4-92.....Cast Iron Threaded Fittings Classes 125 and 250  
ANSI/ASME

B16.12-83.....Cast Iron Threaded Drainage Fittings ANSI/ASME

B16.15-85.....Cast Bronze Threaded Fittings ANSI/ASME

B16.18-84.....Cast Copper Alloy Solder-Joint Pressure  
Fittings ANSI/ASME

B16.22-89.....Wrought Copper and Copper Alloy Solder Joint  
Pressure Fittings ANSI/ASME

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

A47-90.....Ferritic Malleable Iron Castings Revision 1989

A53-95.....Pipe, Steel, Black And Hot-Dipped, Zinc-coated  
Welded and Seamless

A74-94.....Cast Iron Soil Pipe and Fittings

B32-95.....Solder Metal

B61-93.....Steam or Bronze Castings

B62-93.....Composition Bronze or Ounce Metal Castings

B75-93 (Rev A).....Seamless Copper Tube

B88-95.....Seamless Copper Water Tube

B306-95.....Copper Drainage Tube (DWV)

B584-93.....Copper Alloy Sand Castings for General  
Applications Revision A

B687-88.....Brass, Copper, and Chromium-Plated Pipe Nipples

C564-95.....Rubber Gaskets for Cast Iron Soil Pipe and  
Fittings

D2000-90.....Rubber Products in Automotive Applications

E. National Fire Protection Association (NFPA):

54-92.....National Fuel Gas Code

F. American Welding Society (AWS):

A5.8-92.....Filler Metals for Brazing

G. National Association of Plumbing - Heating - Cooling Contractors (PHCC):

National Standard Plumbing Code - 1996

H. Cast Iron Soil Pipe Institute (CISPI):

301-90.....Hubless Cast Iron Soil and Fittings

I. International Association of Plumbing and Mechanical Officials (IAPMO):

Uniform Plumbing Code - 1991

IS6-93.....Installation Standard

J. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-72-92.....General Purpose Ball Valves

SP-80-87.....Gate Valve-Bronze

K. American Society of Sanitary Engineers (ASSE):

1001-70.....Pipe Applied Atmospheric Type Vacuum Breakers

1013-93.....Reduced Pressure Principle Backflow Preventers

1018-86.....Performance for trap seal primer valve-water  
supply fed

1020-81.....Vacuum Breakers, Anti-Siphon, Pressure Type

L. Factory Mutual (FM):

1680-89.....Coupling Used in Hubless Cast Iron Systems for  
Drains, Waste and Vent Systems.

M. Plumbing and Drainage Institute (PDI):

PDI WH-201.....Water Hammer Arrestor

**PART 2 - PRODUCTS**

**2.1 SANITARY, WASTE, STORM WATER DRAIN AND VENT PIPING**

A. Cast Iron Soil Pipe and Fittings: Used for interior waste and vent piping above grade. Pipe shall be modified hub, or plain end (no-hub) as required by selected jointing method.

1. Material, (Pipe and Fittings): ASTM A74, C1SP1-301, Service Class.

2. Joints: Provide any one of the following types to suit pipe furnished.
  - a. Double seal, compression-type molded neoprene gasket. Gaskets shall suit class of pipe being jointed.
    - 1) Stainless steel heavy duty clamp type coupling of elastomeric sealing sleeve, ASTM C564 and a Series 300 stainless steel shield and clamp assembly. Sealing sleeve with center-stop to prevent contact between pipes/fittings being joined shall be marked ASTM C564.
  - b. Adapters: Where service weight pipe is connected to extra heavy pipe and extra heavy fittings of chair carriers, provide adapters or similar system to make tight, leak proof joints.
- B. Steel Pipe and Fittings: May be used for vent piping and storm water piping above grade.
  1. Pipe Galvanized: ASTM A53, standard weight.
  2. Fittings:
    - a. Soil, Waste and Drain Piping: Cast iron, ANSI B16.12, threaded, galvanized.
    - b. Sanitary and Vent Piping: Cast Iron, ANSI B16.4. All piping shall be of the same kind. Couplings of vent piping may be standard couplings furnished with pipe.
    - c. Unions: Tucker connection or equivalent type throughout.
- C. Copper Tube, (DWV): May be used for piping above ground, except for urinal drains.
  1. Tube: ASTM B306.
  2. Fittings:
    - a. Solder type.
  3. Joints: ASTM B32, 50/50, special alloy, lead free. Solder using non-corrosive flux.

## **2.2 INTERIOR DOMESTIC WATER PIPING**

- A. 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, Fed. Spec. WW-U-516. Solder or braze joints.

C. Adapters: Provide adapters for joining screwed pipe to copper tubing.

D. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.

E. Brazing alloy: AWS A5.8, Classification BCuP.

### **2.3 EXPOSED WATER, WASTE, AND MEDICAL GAS PIPING**

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water, waste, connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.

1. Pipe: Fed. Spec. WW-P-351, standard weight.

2. Fittings: ANSI B16.15 cast bronze threaded fittings, (125 and 250).

3. Nipples: ASTM B 687, Chromium-plated.

4. Unions: Fed. Spec. WW-U-516, Brass or Bronze. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

5. Valves: Fed. Spec. WW-V-35, Brass or bronze.

B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09900, PAINTING.

### **2.4 VALVES**

A. Asbestos packing is prohibited.

B. Shut-off:

1. Cold, Hot and Circulating Hot Water:

- a. Fifty millimeter (2 inches) and smaller:

- 1) Ball, Fed. Spec. WW-V-35, Type II, Class 125, Style 1, three piece or double union end construction, full ported, full flow, with solder end connections, 2750 kPa (400 psi) WOG, MSS-SP-67.

### **2.5 TRAP PRIMER WATER PIPING:**

A. Pipe: Copper tube, ASTM B88, type K, hard drawn.

B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.

C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

## **2.6 CLEANOUTS**

- A. Same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts for chemical waste drain pipe shall be of same material as the pipe. Cleanouts shall be easily accessible. Provide a minimum clearance of 600 mm (24 inches) for the rodding.
- B. In Floors: Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. Unit shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, provide clamping collars on the cleanouts. Cleanouts shall consist of "Y" fittings and 3 mm (1/8 inch) 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, provide carpet cleanout markers. Provide two way cleanouts where indicated on drawings.
- C. Provide cleanouts 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. Extend the cleanouts to the wall access cover. Cleanout shall consist of sanitary tees. Furnish nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed roughing work, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required by the NPHCC National Standard Plumbing Code.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

## **2.7 TRAPS**

Provide 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 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.

## **2.8 TRAP PRIMERS**

### **A. Trap Primer (TP-2): Hydraulic.**

1. Fifteen millimeter (1/2 inch) Inlet/ fifteen millimeter (1/2 inch) Outlet fully automatic, all brass trap primer valve, activated by a drop in building water pressure, no adjustment required. Model for one (1) to four (4) traps with distribution unit, may be located anywhere in an active cold water line, as indicated on the drawings or as required by code. ASSE Standard 1018. Omit distribution unit when serving a single trap.

## **2.9 FLOOR DRAINS**

- ### **A. Type C: Cast iron body, double drainage pattern, reversible clamping device, seepage openings, light duty round nickel bronze adjustable strainer and grate with vandal proof screws. One hundred fifty millimeter (6 inch) minimum round grate.**

## **2.10 WATERPROOFING MEMBRANE**

- ### **A. Waterproofing Membrane at all floor drains and roof drains shall be soft copper membrane a minimum of 12" greater than outside diameter of drain collar.**

## **2.11 DIELECTRIC FITTINGS**

- ### **A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.**

## **2.12 WATER HAMMER ARRESTERS**

- ### **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 Dow Corning No. 11 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). Unit shall be as manufactured by Precision Plumbing Products Inc., Watts or Sioux Chief. Provide water hammer arrestors at all solenoid valves, at all groups of two or more flush valves, at all quick opening or closing valves, and at all medical washing equipment.**

## **2.13 STERILIZATION CHEMICALS**

- ### **A. Liquid Chlorine: ASTM E1120.**
- ### **B. Hypochlorite: ASTM E1229, or Fed. Spec. AA-1427C, grade B.**

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

A. General: Comply with the PHCC National Standard Plumbing Code and the following:

1. Install branch piping for water and waste, from the respective piping systems and connect to all fixtures, valves, 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 valves with stem in horizontal position whenever possible. All valves shall be easily accessible. Install valve in each water connection to fixture.
5. Install union and shut-off valve on pressure piping at connections to equipment.
6. All gravity waste drain lines inside the building with vertical drops over 6 m (20 feet) shall be provided with joint restraint on the vertical drop and horizontal offset or branch below the vertical drop. Joint restraint shall be accomplished by threaded, soldered, or grooved joints or a combination of pipe clamps and tie-rods as detailed in NFPA 24. Vertical joint restraint shall be provided from the fitting at the bottom of the vertical drop through every joint up to the riser clamp at the floor penetration of the floor above. Horizontal joint restraint shall be provided from the same fitting at the bottom of the vertical drop through every joint on the horizontal offset or branch for a minimum of 18 m (60 feet) or to anchoring point from the building structure. Joint restraint below ground shall be accomplished by thrust blocks detailed in NFPA 24.
7. All piping shall be supported per of the National Standard Plumbing Code, Chapter No. 8. 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.

8. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

9. 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 07270, 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 07920, SEALANTS AND CAULKING.

B. Piping shall conform to the following:

1. Waste, Storm Water Drain and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
a. 80 mm (3 inches) and smaller	1 : 50 (1/4" to the foot).
b. 80 mm (4 inches) and larger	1 : 100 (1/8" to the foot).

2. Domestic Water:

- a. Where possible, grade all lines to facilitate drainage. Provide drain valves at bottom of risers. All unnecessary traps in circulating lines shall be avoided.
- b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

### 3.2 TESTS

A. General: Test system either in its entirety or in sections.

B. Soil, Waste, Storm Water Drain, and Vent Systems: Conduct before enclosed with drywall and fixtures are connected. Conduct water test or air test, as directed.

1. Water Test: If entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening

except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Keep water in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

2. Air Test: Maintain air pressure of 35 kPa (5 psi) gage for at least 15 minutes without leakage. Use force pump and mercury column gage.

3. Final Tests: To be following or as approved by COTR and AHJ.

a. U-Tube Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with a pressure of 2.6 kPa (two inches of water column) with no loss of pressure as indicated by U-Tube.

C. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 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.

### **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 either liquid chlorine or hypochlorite for sterilization.

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**SECTION 15450  
PLUMBING FIXTURES AND TRIM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Provide 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 07920, SEALANTS AND CAULKING.
- B. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- 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-97.....Supports for Off-the-Floor Plumbing Fixtures for  
Public Use  
  
A112.19.1M-94.....Enameled Cast Iron Plumbing Fixtures  
  
A112.19.2M-98.....Vitreous China Plumbing Fixtures
- C. American Society for Testing and Materials (ASTM):  
  
A276-2002.....Stainless and Heat-Resisting Steel Bars and  
Shapes
- D. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM  
AMP 500-505  
  
Metal Finishes Manual (1988)
- E. American Society of Sanitary Engineers (ASSE):  
  
1016-96.....Performance Requirements for Individual  
Thermostatic, Pressure Balancing and Combination

Pressure Balancing and Thermostatic Control  
Valves for Individual Fixture Fittings

**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 below fixture in accessible location.
- B. Furnish keys for lock shield stops to Contracting Officer's Technical Representative (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

**2.3 ESCUTCHEONS**

- A. 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. Provide key with each laminar flow device.
- B. Flow Control Restrictor:
  1. Capable of restricting flow from 95 to 110 mL/s (1.5 to 1.7 gpm) for lavatories; 125 to 140 mL/s (2.0 to 2.2 gpm) for sinks P-505 through P-520.

2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 and 550 kPa (25 and 80 psi).
3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-clearing action, and is capable of easy manual cleaning. Provide key for each laminar flow device.

C. Device manufactured by faucet manufacturer.

## **2.5 CARRIERS**

- A. ASME/ANSI A112.6.1M, with adjustable gasket faceplate chair carriers for wall hung closets and urinals with auxiliary anchor foot assembly, hanger rod support feet, and rear anchor tie down. Carrier shall be as thin as possible and as shown on Architectural Drawings.
- B. ASME/ANSI A112.6.1M, lavatory, chair carrier for thin wall construction steel plate as detailed on drawing. All lavatory chair carriers shall be capable of supporting the lavatory with a 250-pound vertical load applied at the front of the fixture.

## **2.6 WATER CLOSETS**

- A. (P-104) Water Closet (Wall Hung with Bedpan Washer, ASME/ANSI A112.19.2M, Figure 9) elongated bowl, siphon jet, wall outlet, with bedpan lugs - bedpan washer with grab bar offset, flush valve operated 6 L (1.6 gallons) per flush. Top of rim shall be 460 mm (18 inches) above finished floor. Provide standoff bracket support between studs for bedpan washer at height recommended by the manufacturer.
  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 cap nuts and washers.
  3. Flush valve: Large chloramines resistant diaphragm, semi-red brass valve body, exposed chrome plated, water saver design 6L (1.6 gallons) per flush with maximum 10 percent variance, non-hold-open ADA approved operating side oscillating handle, 25mm (1") IPS screwdriver back check angle stop with vandal resistant cap, adjustable tailpiece, high back pressure vacuum breaker, offset spud coupling for 40mm (1 ½ inch) top spud, cast screw wall and spud flanges, sweat solder adapter with cover tube and wall support at diverter valve body. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM alloy classification for semi-red brass. Set centerline of inlet 673 mm (26 ½ 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-418) Lavatory (Sensor Control, Gooseneck Spout, ASME/ANSI A112.19.2M, Figure 16) straight back, approximately 500 by 450 mm (20 by 18 inches) and a 102 mm (4-inch) maximum apron, first quality vitreous china with punching for gooseneck spout. Set with rim 864 mm (34 inches) above finished floor.
  - 1. Faucet: Solid cast brass construction, chrome plated, gooseneck spout with outlet 102 to 127 mm (8 to 9 inches) above rim. Electronic sensor operated, 102 mm (4 inch) center set mounting, plug-in remote mounted transformer, back check valves, solid brass hot-cold water mixer adjusted from top deck with barrierfree design control handle, and inline filter. Provide laminar flow control device. Breaking the light beam shall activate the water flow. Flow shall stop when user moves away from light beam. Faucet shall be capable of recharging batteries during use by means of an audio-Turnbine.
  - 2. Drain: Cast or wrought brass with flat grid strainer with offset tailpiece, brass, chrome plated. Gird Strainer perforations and manufacture's logo to parallel wall.
  - 3. Stops: Angle type. See paragraph 2.2. Stops
  - 4. Trap: Cast copper alloy, 40 by 32 mm (1-1/2 by 1-1/4 inch) 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.

## **2.8 SHOWER BATH FIXTURE**

- A. (P-701) Shower Bath Fixture (Wall Mounted, Concealed Supplies, Hose Spray):
  - 1. Shower Installation: Wall mounted showerhead connected to shower arm.
  - 2. Shower Heads: Chrome plated metal head, adjustable ball joint, self cleaning head with automatic flow control device to limit discharge to not more than three gpm. Body, internal parts of shower head and flow control fittings shall be copper alloy or CRS. Install showerhead 1800 mm (72 inches) above finished floor. Also there shall be a diverter valve for a handheld shower head. Handheld shower head should meet the same specification as fixed shower head. Provide on-



off thumb switch on handheld showerhead. Hand held shall be mounted on full-size grab bar.

3. Valves: Type T/P combination temperature and pressure balancing, with chrome plated metal lever type operating with adjustment for rough-in variations handle and chrome plated metal or CRS face plate. Install diverter selector valve and elevated vacuum breaker to provide tempered water to shower head and hose spray. Valve body shall be any suitable copper alloy. Internal parts shall be copper nickel alloy, CRS or thermoplastic material. Valve inlet and outlet shall be 15 mm (1/2-inch) IPS. Provide external screwdriver check stops, and temperature limit stops. Set stops for a maximum temperature of 105 degrees F. All exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 380 mL/s at 310 kPa (6 gpm at 45 psi) pressure drop.

## **2.9 THERMOSTATIC MIXING VALVES**

- A. Emergency fixture water mixing valve shall consist of liquid-filled thermal motor and a piston control mechanism with positive shut off of hot water when cold water supply is lost to prevent scalding. In addition, the valve shall allow cold flow in the event of loss or interruption of the hot water supply or thermostat failure. The valve shall control outlet temperature over a wide flow range and will be suitable for drench shower and/or eyewash applications. Temperature adjustment will be vandal resistant.

## **PART 3 - EXECUTION**

- A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section, SEALANTS AND CAULKING.
- B. Support and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.
- C. Toggle Bolts: For hollow masonry units, finished or unfinished.
- D. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4-inch) diameter bolts, and to extend at least 75 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.
- E. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.

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F. 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.

G. Do not use aerators on lavatories and sinks.

### **3.2 CLEANING**

A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

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**SECTION 16050**  
**BASIC METHODS AND REQUIREMENTS (ELECTRICAL)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This Section, Basic Methods and Requirements (Electrical) applies to all sections of Division 16.
- B. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, switchboards, switchgear, panelboards, motor control centers, 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 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 or device of a kind mentioned which:

- a. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.
  - b. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.
2. Labeled; equipment or device is when:
- a. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
  - b. The laboratory makes periodic inspections of the production of such equipment.
  - c. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
3. Certified; equipment or product is 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 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 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 reinspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

#### **1.6 EQUIPMENT REQUIREMENTS**

- A. Where variations from the contract requirements are requested in accordance with Section 01001, GENERAL CONDITIONS and Section 01340, SAMPLES AND SHOP DRAWINGS, 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.

#### **1.7 EQUIPMENT PROTECTION**

- A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
  2. 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.
  3. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
  4. 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.

#### **1.8 WORK PERFORMANCE**

- A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, 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 deenergized. 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 while working on energized systems in accordance with NFPA 70E.
  2. Electricians must wear personal protective equipment while working on energized systems in accordance with 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 Director of the Medical Center.
  5. When working in a 277/480 or higher there shall be 2 workers present, one being a Journeyman.
  6. Prior to removing the safety cover from any Electrical Panel, the contractor shall have a VA Electrician present.
- 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 01010, GENERAL REQUIREMENTS.
- E. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01010, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interferences. See Section 01010, GENERAL REQUIREMENTS.

#### **1.9 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 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.

#### **1.10 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 panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.
- B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4 inch) high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

#### **1.11 SUBMITTALS**

- A. Submit in accordance with section 01340, SAMPLES AND SHOP DRAWINGS.
- 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. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

F. Manuals: Submit in accordance with Section 01010, 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 and maintenance instructions.
  - e. Safety precautions.
  - f. Diagrams and illustrations.
  - g. Testing methods.
  - h. Performance data.

- i. Lubrication schedule including type, grade, temperature range, and frequency.
  - j. 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.
  - k. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified 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, outlet box, manual motor starter, device plate, engraved nameplate, wire and cable splicing and terminating material and single pole molded case circuit breaker.
  - 6. Each type of light fixture specified in Section 16510 or shown on the drawings.
- I. Contractor shall complete the information data on all maintenance equipment installed under the 16000 spec series. Verify with COTR on necessary equipment.

#### **1.12 SINGULAR NUMBER**

- A. 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.

#### **1.13 TRAINING**

- A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01010, GENERAL REQUIREMENTS.

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- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- C. A training schedule shall be developed and submitted by the contractor and approved by the Resident Engineer at least 30 days prior to the planned training.

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**SECTION 16111**  
**CONDUIT 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. Sealing around penetrations to maintain the integrity of fire rated construction: Section 07270, FIRESTOPPING SYSTEMS.
- B. Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building: Section 07920, SEALANTS AND CAULKING.
- C. Identification and painting of conduit and other devices: Section 09900, PAINTING.
- D. General electrical requirements and items that is common to more than one section of DIVISION 16: Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- E. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 16450, GROUNDING.

**1.3 SUBMITTALS**

In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS, furnish the following:

- A. 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.
  - 4. The specific item proposed and its area of application shall be identified on the catalog cuts.
- B. Certification: Prior to final inspection, deliver to the COTR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

#### 1.4 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 the basic designation only.
- B. National Fire Protection Association (NFPA):
- 70-05.....National Electrical Code (NEC)
- C. Underwriters Laboratories, Inc. (UL):
- 1-03.....Flexible Metal Conduit
- 5-01.....Surface Metal Raceway and Fittings
- 6-03.....Rigid Metal Conduit
- 50-03.....Enclosures for Electrical Equipment
- 360-03.....Liquid-Tight Flexible Steel Conduit
- 467-01.....Grounding and Bonding Equipment
- 514A-01.....Metallic Outlet Boxes
- 514B-02.....Fittings for Cable and Conduit
- 514C-05.....Nonmetallic Outlet Boxes, Flush-Device Boxes and  
Covers
- 651-02.....Schedule 40 and 80 Rigid PVC Conduit
- 651A-03.....Type EB and A Rigid PVC Conduit and HDPE Conduit
- 797-03.....Electrical Metallic Tubing
- 1242-00.....Intermediate Metal Conduit
- D. National Electrical Manufacturers Association (NEMA):
- TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and  
Tubing
- FB1-03.....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 13 mm (3/4 inch) unless otherwise shown. Where permitted by the NEC, 13 mm

(1/2 inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.
2. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.
3. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.
4. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.
5. Flexible galvanized steel conduit: Shall Conform to UL 1.
6. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
  - a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
  - b. Standard threaded couplings, locknuts, bushings, 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. Set screws are approved for 2 inch and larger conduits only.
  - 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.

2. Rigid aluminum conduit fittings:

- a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
- b. Locknuts and bushings: As specified for rigid steel and IMC conduit.
- c. Set screw fittings: Not permitted for use with aluminum conduit.

3. Electrical metallic tubing fittings:

- a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
- b. Only steel or malleable iron materials are acceptable.
- c. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
- 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 ANSI/ 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.
- 7. Expansion and deflection couplings:
  - a. Conform to UL 467 and UL 514B.
  - b. Accommodate, 19 mm (0.75 inch) 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 fault currents in accordance with UL 467, and the NEC code tables for ground 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 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) 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 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.

### **PART 3 - EXECUTION**

#### **3.1 PENETRATIONS**

A. Cutting or Holes:

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the COTR prior to drilling through structural sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COTR as required by limited working space.

- B. Fire Stop: 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, FIRESTOPPING SYSTEMS, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section, SEALANTS AND CAULKING.

#### **3.2 INSTALLATION, GENERAL**

- A. In accordance with UL, NEC, as shown, and as hereinafter specified.
- B. Essential (Emergency) raceway systems shall be entirely independent of other raceway systems, except where specifically "accepted" by NEC Article 517.
- C. Install conduit as follows:
1. In complete runs before pulling in cables or wires.
  2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
  3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.

5. Mechanically and electrically continuous.
6. Independently support conduit at 8'.0" on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
7. Support within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. 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.
10. Do not use aluminum conduits in wet locations.
11. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.
12. Do not anchor conduit to walls in a parallel run. All conduit shall be attached independently of wall systems.

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.
4. 360° worth of bends maximum allowed. Four bends maximum allowed.

E. Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown on the drawing. Coordinate with other trades so conduit and "j" boxes are accessible for maintenance.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COTR.

F. Fire Alarm:

1. Fire alarm conduit shall be painted red (a red "top-coated" conduit from the conduit manufacturer may be used in lieu of painted conduit) in accordance with the requirements of Section 13850-"Fire Alarm Systems".
2. Do not daisy chain outlets. Go up, not side-to-side in walls.

### **3.3 CONCEALED WORK INSTALLATION**

#### **A. Furred or Suspended Ceilings and in Walls:**

1. Conduit for conductors above 600 volts:
  - a. Rigid steel or rigid aluminum.
  - b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
2. Conduit for conductors 600 volts and below:
  - a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (four feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws 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 volts and below:
  1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited. All exposed conduit runs from floor to 6' high shall be rigid steel.
  2. All exposed conduit runs from floor to 6 foot high shall be rigid steel.
- 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 2400 mm (eight foot) intervals.

F. Surface metal raceways: Use only where shown.

G. Painting:

1. Paint exposed conduit as specified in Section, PAINTING.

### **3.5 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 1500 mm (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall include an outer factory coating of .5 mm (20 mil) bonded PVC or field coat with asphaltum before installation. After installation, completely coat damaged areas of coating.

### **3.6 MOTORS AND VIBRATING EQUIPMENT**

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Provide liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside (air stream) of HVAC units, and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with flexible metal conduit.

### **3.7 EXPANSION JOINTS**

- A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.
- C. Install expansion and deflection couplings where shown.

### **3.8 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- 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 90 kg (200 pounds). 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 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
    - b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
    - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted.
- G. Bolts supported only or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by 84P bd is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- L. 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.

### **3.9 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 in the same wall mounted back-to-back are prohibited. A minimum 600 mm (24 inch), center-to-center lateral spacing shall be maintained between boxes.)

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) 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.

### **3.10 PHONE/DATA/FIRE ALARM/CONTROL CONDUIT**

A. Install the telephone raceway system as shown on drawings.

B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.

C. All conduit ends shall be equipped with insulated bushings.

D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.

E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.

F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter closets next to the wall and be flush with the backboard.

- G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- H. All empty conduits located in closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of telephone conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

- J. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

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**SECTION 16127**  
**CABLES, LOW VOLTAGE (600 VOLTS AND BELOW)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

**1.2 RELATED WORK**

- A. Sealing around penetrations to maintain the integrity of time rated construction: Section 07270, FIRESTOPPING SYSTEMS.
- B. General electrical requirements that are common to more than one section in Division 16: Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- C. Conduits for cables and wiring: Section 16111, CONDUIT SYSTEMS.
- D. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 16450, GROUNDING.

**1.3 SUBMITTALS**

- A. In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS, furnish the following:
1. Manufacturer's Literature and Data: Showing each cable type and rating.
  2. Certificates: Two weeks prior to final inspection, deliver to the COTR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

**1.4 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 the basic designation only.
- B. American Society of Testing Material (ASTM):
- D2301-04.....Standard Specification for Vinyl Chloride  
Plastic Pressure Sensitive Electrical Insulating  
Tape
- C. Federal Specifications (Fed. Spec.):



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A-A-59544-00.....Cable and Wire, Electrical (Power, Fixed  
Installation)

C. National Fire Protection Association (NFPA):

70-05.....National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

4-01.....Armored Cable

44-02.....Thermoset-Insulated Wires and Cables

83-03.....Thermoplastic-Insulated Wires and Cables

467-01.....Electrical Grounding and Bonding Equipment

486A-01.....Wire Connectors and Soldering Lugs for Use with  
Copper Conductors

486C-02.....Splicing Wire Connectors

486D-02.....Insulated Wire Connector Systems for Underground  
Use or in Damp or Wet Locations

486E-00.....Equipment Wiring Terminals for Use with Aluminum  
and/or Copper Conductors

493-01.....Thermoplastic-Insulated Underground Feeder and  
Branch Circuit Cable

514B-02.....Fittings for Cable and Conduit

1479-03.....Fire Tests of Through-Penetration Fire Stops

**PART 2 - PRODUCTS**

**2.1 CABLE AND WIRE (POWER AND LIGHTING)**

A. Cable and Wire shall be in accordance with Fed. Spec. A-A-59544, except  
as hereinafter specified.

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. THW, XHHW, or dual rated THHN-THWN shall be in accordance with UL 44,  
and 83.

2. Isolated power system wiring: Type XHHW with a dielectric constant of 3.5 or less.

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. The lighting circuit "switch legs" and 3-way switch "traveling wires" shall have color coding unique and distinct (i.e. pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Field coordinate for a final color coding with the COTR.
2. Use solid color compound or solid color coating for No. 12 AWG and No. 10 AWG branch circuit conductors and neutral sizes.
3. Phase conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
  - a. Solid color compound or solid color coating.
  - b. Stripes, bands, or hash marks of color specified above.
  - c. Color as specified using 19 mm (3/4 inch) wide tape. Apply tape in half overlapping turns for a minimum of 75 mm (three inches) for terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes. 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.
5. Color code for isolated power system wiring shall be in accordance with the NEC.

## **2.2 SPLICES AND JOINTS**

- A. In accordance with UL 486A, C, D, E and NEC.
- B. Branch circuits (No. 10 AWG and smaller):
  - 1. Connectors: Solderless, screw-on, reusable pressure cable type, 600 volt, 105 degree 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 manufacturers packaging shall be strictly complied with.
- C. Feeder Circuits:
  - 1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material.
  - 2. Field installed compression connectors for cable sizes 250 kcmil and larger shall have not less 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. Insulate with not less than that of the conductor level that is being joined.
  - 4. Plastic electrical insulating tape: ASTM D2304 shall apply, flame retardant, cold and weather resistant.

## **2.3 CONTROL WIRING**

- A. Unless otherwise specified in other sections of these specifications, control wiring shall be as specified for power and lighting wiring, except the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

## **2.4 COMMUNICATION AND SIGNAL WIRING**

- A. Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown.
- B. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.
- C. Multi-conductor cables shall have the conductors color coded.

## **2.5 WIRE LUBRICATING COMPOUND**

- A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.
- B. Shall not be used on wire for isolated type electrical power systems.

## **2.6 FIREPROOFING TAPE**

- A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.
- B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.
- C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.
- D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.
- E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, 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 (i.e. 120V, 277V) 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 panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.
- G. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- H. Wire Pulling:
  - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.

2. Use ropes made of nonmetallic material 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 Resident Engineer.
4. Pull in multiple cables together in a single conduit.
- I. No more than (3) single-phase branch circuits shall be installed in any one conduit.
- J. The wires shall be derated in accordance with NEC Article 310. Neutral wires, under conditions defined by the NEC, shall be considered current-carrying conductors.

### **3.2 SPLICE INSTALLATION**

- A. Splices and terminations shall be mechanically and electrically secure.
- B. 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 CONTROL, COMMUNICATION 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 panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- D. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- E. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

### **3.4 CONTROL, COMMUNICATION AND SIGNAL SYSTEM 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.
- D. In each handhole install embossed brass tags to identify the system served and function.

### **3.5 FEEDER IDENTIFICATION**

- A. In each interior pulbox and junction box, install metal tags on each circuit cables and wires to clearly designate their circuit identification and voltage.
- B. In each handhole, provide tags of the embossed brass type, showing the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

### **3.6 EXISITNG WIRING**

- A. Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

### **3.7 FIELD TESTING**

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.
- B. Tests shall be performed by megger and conductors shall test free from short-circuits and grounds.
- C. Test conductor phase-to-phase and phase-to-ground.
- D. The Contractor shall furnish the instruments, materials, and labor for these tests.

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**SECTION 16140**  
**WIRING DEVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation and connection of wiring devices.

**1.2 RELATED WORK**

- A. Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL): General electrical requirements that are common to more than one section of Division 16.
- B. Section 16111, CONDUIT SYSTEMS: Conduits and outlets boxes.
- C. Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW): Cables and wiring.
- D. Section 16450, GROUNDING: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

**1.3 SUBMITTALS**

- A. In accordance with Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL), 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.

**1.4 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):

70-02.....National Electrical Code (NEC)

C. National Electrical Manufacturers Association (NEMA):

WD 1-99.....General Color Requirements for Wiring Devices

WD 6-02 .....Wiring Devices - Dimensional Requirements

D. Underwriter's Laboratories, Inc. (UL):

5-96.....Surface Metal Raceways and Fittings

20-00.....General-Use Snap Switches

231-98.....Power Outlets

467-93.....Grounding and Bonding Equipment

498-01.....Attachment Plugs and Receptacles

943-03.....Ground-Fault Circuit-Interrupters

**PART 2 - PRODUCTS**

**2.1 RECEPTACLES**

A. General: All receptacles shall be listed by Underwriters Laboratories, Inc., as hospital grade (green dot identification) 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 shall be 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. Bodies shall be red in color. Wall plates shall be red with the word "EMERGENCY" engraved in 6 mm, (1/4 inch) white letters.

4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box.

- a. Ground fault interrupter shall be hospital grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20-ampere branch circuit. 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. Devices shall meet UL 943. Color shall be ivory.

5. Isolated Ground Type Duplex Receptacles:

- a. Bodies shall be orange in color.
- b. Shall be hospital grade and UL listed as "Isolated Ground".

C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete with appropriate cord grip plug. Devices shall meet UL 231.

**2.2 TOGGLE SWITCHES AND DIMMERS**

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. Toggle shall be smooth in operation and have a positive snap "on-off" contact.

1. 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.

2. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.

3. Ratings:

- a. 120 volt circuits: 20 amperes at 120-277 volts AC.

- b. 277 volt circuits: 20 amperes at 120-277 volts AC.
  - 4. The switches shall be mounted on the striker plate side of doors.
  - 5. Incorporate barriers between switches with multigang outlet boxes where required by the NEC.
  - 6. Switches connected to isolated type electrical power systems shall be double pole.
  - 7. All toggle switches shall be of the same manufacturer.
- B. Dimmers: Incandescent modular dimming systems.
- 1. Incandescent dimming system shall be 2000 watt modular type, with capability for "slaving" larger loads from the "master". System shall have capability of adding additional "slaves", controlled from the original basic dimmer "master". All units shall track with "master". Control units shall be single-phase manual control, three-phase manual motorized control as shown on the drawings. Dimmers shall have low and intensity adjustment and built-in transient voltage protection and fused on the load side. All remote mounted units shall be completely enclosed in integral metal housing. "Master", "Slaves" and controls shall be of the same manufacturer. All dimmers shall be listed by Underwriters Laboratories, Inc.
- C. Dimmers: Incandescent lamp loads. Wall-mounted incandescent dimmers shall be specification grade with capability of raising and lowering the lighting from completely off at extreme counter-clockwise rotation, to full intensity. Dimmers shall include an "off" position. Dimmers shall maintain full load rating even when two or more units are installed adjacent to one another. All wall-mounted dimmers shall be of the same manufacturer.
- D. Dimmers: Fluorescent lamp loads. Wall-mounted fluorescent lamp dimmers shall be specification grade with large control knob and shall be capable of raising and lowering the lighting from completely off at extreme counter-clockwise rotation, to full intensity. Dimmers shall include an "off" position. Dimmers shall have low end intensity adjustment and maintain full load rating even when two or more units are installed adjacent to one another. All wall-mounted dimmers shall be of the same manufacturer. Dimming ballast shall be provided for each F32 rapid start lamp or pair of lamps. Dimmers shall have adequate capacity for the load served and the environment in which installed.

### **2.3 WALL PLATES**

- A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.
- B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.
- C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- D. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.

### **2.4 SURFACE MULTIPLE-OUTLET ASSEMBLIES**

- A. Assemblies shall conform to the requirements of NFPA 70 and UL 5.
- B. Shall have the following features:
  - 1. Enclosures:
    - a. Thickness of steel shall be not less than 1 mm (0.040 inch) steel for base and cover. Nominal dimension shall be 40 by 70 mm (1-1/2 by 2-3/4 inches) with inside cross sectional area not less than 2250 square mm (3.5 square inches). The enclosures shall be thoroughly cleaned, phosphatized and painted at the factory with primer and the manufacturer's standard baked enamel or lacquer finish.
  - 2. Receptacles shall be duplex, hospital grade. See paragraph 'RECEPTACLES' in this section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.
  - 3. Unless otherwise shown on drawings, spacing of the receptacles along the strip shall be 600 mm (24 inches) on centers.
  - 4. Wires within the assemblies shall be not less than No. 12 AWG copper, with 600 volt ratings.
  - 5. Installation fittings shall be designed for the strips being installed including bends, offsets, device brackets, inside couplings, wire clips, and elbows.
  - 6. Bond the strips to the conduit systems for their branch supply circuits.

**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.

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**SECTION 16450**  
**GROUNDING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies general grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

**1.2 RELATED WORK**

- A. Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL): General electrical requirements and items that are common to more than one section of Division 16.
- B. Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- 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 COTR:
  - 1. Certification that the materials and installation is in accordance with the drawings and specifications.
  - 2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

#### 1.4 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 the basic designation only.

A. National Fire Protection Association (NFPA):

70-2002.....National Electrical Code (NEC)

99-2002.....Health Care Facilities

B. Underwriters Laboratories, Inc. (UL):

44-1999.....Thermoset-Insulated Wires and Cables

83-1998.....Thermoplastic-Insulated Wires and Cables

467-1993.....Grounding and Bonding Equipment

486A-2000.....Wire Connectors and Soldering Lugs for Use With  
Copper Conductors

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

B1-2001.....Standard Specification for Hard-Drawn Copper  
Wire

B8-1999.....Standard Specification for Concentric-Lay-  
Stranded Copper Conductors, Hard, Medium-Hard,  
or Soft

D. 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

## PART 2 - PRODUCTS

### 2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG and smaller shall be ASTM B1 solid bare copper wire.

C. Isolated Power System: Type XHHW-2 insulation with a dielectric constant of 3.5 or less.

- D. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

### **2.3 SPLICES AND TERMINATION COMPONENTS**

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified.
- 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.
  - 3. Isolation transformers and isolated power systems shall not be system grounded.
- 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 Chapter 4, "Electrical Systems ", of NFPA 99, and Article 517, "Health Care Facilities" of NFPA 70.

### **3.2 INACCESSIBLE GROUNDING CONNECTIONS**

- A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

### **3.3 SECONDARY EQUIPMENT AND CIRCUITS**

- A. Conduit Systems:
  - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
  - 2. Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.

3. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.
- 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.
  3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- D. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
- E. 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.
- F. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

### **3.4 CONDUCTIVE PIPING**

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
- B. In operating rooms and at intensive care and coronary care type beds, bond the gases and suction piping, at the outlets, directly to the room or patient ground bus.

### **3.5 TELECOMMUNICATIONS SYSTEM**

- A. Bond telecommunications system grounding equipment to the electrical grounding electrode system.



### **3.7 GROUNDING FOR RF/EMI CONTROL**

- A. Install bonding jumpers to bond all conduit, cable trays, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 4" wide copper strip or two No. 10 copper conductors spaced minimum 4" apart. Use No. 4 copper where exposed and subject to damage.
- B. Comply with the following when shielded cable is used for data circuits.
  - 1. Shields shall be continuous throughout each circuit.
  - 2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.
  - 3. Do not connect shields from different circuits together.
  - 4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

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**SECTION 16510  
BUILDING LIGHTING, INTERIOR**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation and connection of the interior lighting systems.

**1.2 RELATED WORK**

- A. Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL): General requirements that are common to more than one section of Division 16.
- B. Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW): Cables and wiring.
- C. Section 16140, WIRING DEVICES: Wiring devices used as part of the lighting systems.
- D. Section 16450, GROUNDING: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS, in Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Refer to Paragraph, GUARANTY, in Section 01001, GENERAL CONDITIONS.

**1.4 SUBMITTALS**

- A. In accordance with Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL), 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, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, lenses, louvers, lamps, and controls.
  - 3. When catalog data and/or shop drawings for fluorescent fixtures are submitted for approval, photometric data from an independent testing laboratory shall be included with the submittal, indicating average brightness and efficiency of the fixture, as specified in specification or as shown on the drawings. Coefficient of utilization data will not be considered a suitable substitute.
- 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.
  - b. Include with shop drawings, certification from the manufacturers that all electronic high-frequency ballasts meet the transient protection required by IEEE C62.41, Cat. A. Include with initial shop drawing submittal.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
- C78.1-91.....Fluorescent Lamps - Rapid-Start Types -  
Dimensional and Electrical Characteristics
- C78.2-91.....Fluorescent Lamps - Preheat-Start Types -  
Dimensional and Electrical Characteristics
- C78.3-91.....Fluorescent Lamps - Instart Start and Cold-  
Cathode Types - Dimensional and Electrical  
Characteristics
- C78.376-91.....Chromaticity of Fluorescent Lamps (ANSI/NEMA  
C78/376-96)
- C. Certified Ballast Manufacturers Association (CBM):
- Requirements for Ballast Certification.
- D. Institute of Electrical and Electronic Engineers (IEEE):
- C62.41-91.....Recommended Practice on Surge Voltage in Low  
Voltage AC Power Circuits
- E. National Fire Protection Association (NFPA):

70-02.....National Electrical Code (NEC)

101-00.....Life Safety Code

F. 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

G. 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

H. 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 NFPA 70, UL 1598 and shall be 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. Where lighting fixtures are detailed with minimum 20 gauge housing, minimum 22 gauge housings will be acceptable provided they have strengthening embossed rib and break formations, which give the equivalent rigidity of a 20 gauge housing.

4. 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.
  5. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and 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. Contacts for recessed double contact lampholders and for slimline lampholders shall be silver plated. Lampholders for bi-pin lamps, with the exception of those for "U" type 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.
  2. Incandescent: Shall have porcelain enclosures and conform to the applicable requirements of UL 496.
- E. Fluorescent fixtures with louvers or light transmitting panels shall have hinges, latches and safety catches to facilitate safe, convenient cleaning and relamping. Vapor tight fixtures shall have pressure clamping devices in lieu of the latches.
- F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, and hinged housings) 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 his 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.

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. Provide all lighting fixtures with a specific means for grounding their metallic wireways and housings to an equipment grounding conductor.
- I. Light Transmitting Components for Fluorescent Fixtures:
1. Shall be 100 percent virgin acrylic plastic
  2. Flat lens panels shall have not less than 3.2 mm (1/8 inch) 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. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures. Fixtures shall be designed for lamps as specified.

## **2.2 FLUORESCENT LAMP BALLASTS**

- A. Where applicable, fluorescent lamps and ballasts shall comply with the National Energy Policy Act of 1992.
- B. Ballasts shall comply with NEMA 82.1, 82.2 and 82.11, NFPA 70, and UL 935 unless otherwise specified.
- C. Lamp types F32T8 shall be operated by electronic, high frequency ballasts. Lamp types shall be operated by the standard energy saving electromagnetic core-and-coil ballasts. For these applications, the lamps shall be operated by core-and-coil ballasts where specifically required on the drawings.
- D. Electronic high-frequency ballasts:
1. Ballasts shall operate the lamps at a frequency between 20 and 60 KHz from an input frequency of 60Hz.
  2. Ballast package:

- a. Size: The ballast case shall be sized to be physically interchangeable with standard core-and-coil ballasts and suitable for standard mounting in new or existing lighting fixtures.
  - b. Case marking: Mark the ballast to indicate the required supply voltage, frequency, RMS current, current surge during starting, input watts, and power factor at the design center voltage, open circuit voltage, crest factor and efficacy.
3. Performance:
- a. Light output:
    - 1) At the design voltage, the light output shall be at least equal to that obtained by a core-and-coil ballasted system meeting ANSI, NEMA and CBM standards. The comparison test shall be measured in the same fixture at 25 degrees C (plus or minus one degree) ambient room temperature.
    - 2) Tests shall be made in fixtures designed only for the number of lamps being tested.
    - 3) For other applications (higher ambients) the tests should be operated with equivalent lamp wall temperatures plus or minus 4 degrees C.
  - b. Efficacy: The efficacy of the high-frequency, electronically ballasted system shall be at least 15 percent greater than the equivalent CBM core-and-coil ballasted system (see "Light output" above).
  - c. Starting: The ballast shall be capable of starting and maintaining operation of lamps at an ambient temperature of 10 degrees C (50 degree F) or more for an input voltage of plus or minus 10 percent about the center design voltage unless otherwise indicated. The ballast shall never be started in the instant start mode at any temperature.
  - d. Operation:
    - 1) The ballast shall safely and reliably operate in a room ambient temperature from 10 degrees C (50 degree F) to 40 degrees C (105 degree F).
    - 2) The light output shall not vary by more than plus or minus 5 percent for a plus or minus 10 percent variation of the input voltage about the center design voltage. Light output shall

remain constant for a plus or minus 5 percent variation of the input voltage.

3) The ballast shall operate the lamps in a manner that will not adversely curtail the normal life of the lamp.

e. Transient protection: The ballast shall comply with IEEE C62.41, Cat. A.

f. Flicker: The flicker shall be less than 5 percent and without visible flicker.

g. Noise: The audible noise levels should be equivalent to or better than the Class A rating of CBM certified ballasts.

h. Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI): The EMI and RFI limits shall meet the requirements of the Federal Communications Commission Rules and Regulations (CFR 47 Part 18).

i. Rated life: The ballast shall have a rated life of 10 years or 30,000 hours (based on a 10 hour day).

j. The two-lamp ballast shall safely operate two F32T8 RS, 32-watt lamps. The single lamp ballast shall safely operate one F32T8 RS, 32-watt lamp.

k. Power factor: Not less than 95 percent.

l. Reliability:

1) Labels: Ballasts must be labeled or listed by UL and CBM/ETL.

2) Submit, simultaneously with shop drawings, a certified test report by an independent testing laboratory showing that the electronic ballasts meet or exceed all the performance requirements in this specification.

m. Total harmonic distortion (THD) shall be less than 10 percent.

E. Ballasts for lighting fixtures controlled by dimming devices shall be the electronic, high frequency type as specified herein, equipped for dimming and conform to the recommendations of the manufacturer of the associated dimming devices to assure satisfactory operation of the lighting system.

F. All ballasts serving straight lamps shall be mounted by four non-turning studs (or captive bolts) equipped with lock washers and nuts or locking type nuts, or by four thread cutting (TC) sheet metal screws which are



firmly secured against the fixture body (or wireway) to maximize dissipation of heat and minimize noise. Exception: electronic high-frequency ballasts may be mounted at a minimum of two points, one at each end of unit.

- G. 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.
- H. 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.

### **2.3 LAMPS**

#### **A. Fluorescent Lamps:**

- 1. Rapid start fluorescent lamps shall comply with ANSI C78.1; preheat-start type shall comply with ANSI C78.2; and instant-start and cold-cathode lamps shall comply with ANSI C78.3.
- 2. Chromacity of fluorescent lamps shall comply with ANSI C78.376.
- 3. The lamps shall include the F32T8 watt energy saving.
- 4. Except as indicated below, lamps shall be energy saving type, have a color temperature between 3500 and 4100°K, a Color Rendering Index (CRI) of not less than 75, and an initial lumen output not less than 2800.
  - a. In utility areas (Electrical, Communication and Mechanical) Service rooms and closets), maintenance closets and non-medical storage spaces, utilize energy saving light-white lamps.
  - b. In areas with ambient temperatures below 60 degrees use the 40 watt version of the lamp above.
  - c. Other areas as indicated on the drawings.

#### **B. Incandescent lamps shall be the general service, inside frosted type rated 130 volts except where otherwise shown on the drawings.**

#### **C. Compact Fluorescent Lamps: Shall be 3500°K, 10,000 hours average rated life, and as follows:**

- 1. T4, double twin tube rated

## **2.4 OCCUPANT SENSOR LIGHTING CONTROL SYSTEMS**

- A. General: A dual technology sensor shall be utilized to control the "On-Off" actuation of fluorescent or incandescent lighting loads. It shall provide control of an isolated set of contacts on exposure to a perceived change in environmental conditions indicating the presence or absence of one or more persons or sounds. It shall maintain the contacts closed in the presence of continued changes (due to human presence) at similar intensity and rate. It shall open the contacts at a nominal time after the changes cease. Should have capability to adapt and learn the surrounding environment.
1. Dual technology type.
  2. Adaptive technology.
  3. Ceiling mounted and suitable for damp locations.
  4. Non-volatile memory settings retained after power outage.
  5. Capable of controlling 277V light circuit.
  6. Must provide all required components (power packs, relays, fuses transformers, etc.) for a complete and operable system.
  7. On - off - auto capability.
- B. Range of detection: The sensor(s) shall provide effective coverage of a room, sensing the presence of one or more people, or sound changes, in the room in order to turn the lights on. The ceiling mounted sensor's area of coverage shall be approximately a 4200 mm (14 feet) diameter circle at 1800 mm (6 feet) away. Provide sufficient units to give full coverage as measured 750 mm (30 inches) above the floor. A field-of-view adjustment feature shall be provided to allow orientation to various room operating conditions.
1. Sensor placement: Locate the sensor(s) in accordance with the manufacturer's recommendations to maximize energy savings by avoiding nuisance activation due to sudden temperature or air flow changes. Locate the units within 1800 mm (6 feet) horizontally of work stations or major points of activity, including the center of room entrance doors.
- C. Timing/Function: Shall not be user adjustable. Lighting shall remain on with one or more persons within the covered area. The system shall be factory set to maintain lights on for a minimum of 8 minutes and not longer than 12 minutes after the area of coverage is vacated. For

testing purposes, there shall be a means to change the pre-set time delay to 30 seconds or less.

- D. Control Unit: The system shall have a switching relay(s) capable of switching the fluorescent or incandescent loads as required. Contacts shall be rated at a minimum of 15 Amps at voltages to 277, with expected cycles of operation in excess of 100K. Power derived from a current limiting 24 volt transformer shall power the system and the unit must be packaged for installation on a standard 200 mm x 200 mm (4 inch x 4 inch) NEMA box enclosure. The unit shall be wired through a conventional wall switch to provide an over-ride system "Off" and active "Off-On" functioning.
- E. Field Wiring: The wiring between the control unit and sensor(s) shall be an insulated multi-conductor, #22 gauge Poly Vinyl Chloride (PVC) jacketed cable.

## **2.5 EXIT LIGHT FIXTURES**

- A. Exit light fixtures shall meet applicable requirements of NFPA 101 and UL 924.
- B. Housing and Canopy:
1. Shall be made of cast or extruded aluminum, or rolled steel.
  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. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous red 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; maximum of 3.5 watts for single face and 7 watts for double-faced fixtures that do not use diffuser panels in front of the LEDs. LED exit light fixtures that use diffuser

panels shall require a maximum of 1.0 watt per fixture for single or double face fixtures.

2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltages: Fixtures shall be wired for 277-volt operation.

### **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. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Resident Engineer.
- D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.
- E. Lighting Fixture Supports:
  1. Shall provide support for all of the fixtures. Supports shall be anchored to the structural slab. Support the light fixture with a tie wire in all four corners of the unit. Where the fixture is supported by the ceiling system, make sure the ceiling system is supported at all four corners of the fixture.
  2. Shall maintain the fixture positions after cleaning and relamping.
  3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
  4. Hardware for recessed lighting fixtures:
    - a. All fixture mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of 400 percent of the fixture weight.

- b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass through the ceiling member (T-bar, channel or spline), or it may extend over the inside of the flange of the channel (or spline) that faces away from the fixture, in a manner that prevents any fixture movement.
  - c. In addition to the above, the following is required for fixtures exceeding 9 kg (20 pounds) in weight. Note: Ceiling types are defined in ASTM Standard C635-69.
    - 1) Where fixtures mounted in "Intermediate" and "Heavy Duty" ceilings weigh between 9 kg and 25 kg (20 pounds and 56 pounds) provide two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
    - 2) Where fixtures weigh over 25 kg (56 pounds) they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.
  - d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
7. Surface mounted lighting fixtures:
- a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4-20) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.

- b. Where ceiling cross runners are installed for support of lighting fixtures they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
  - c. Fixtures less than 6.8 kg (15 pounds) in weight and occupying less than 600 mm x 600 mm (two square feet) of ceiling area may, (when designed for the purpose) be supported directly from the outlet box when all the following conditions are met.
    - 1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
    - 2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
    - 3) The outlet box is supported vertically from the building structure.
  - d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
8. Single or double pendent-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.
- G. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.
- H. 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.
- I. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 16450, GROUNDING.

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J. At completion of project, relamp all fixtures which have failed/burned-out lamps. Clean all fixtures, lenses, diffusers and louvers that have accumulated dust/dirt during construction.

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**SECTION 16761**  
**AUDIO VISUAL NURSE CALL AND CODE ONE SYSTEMS AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This document specifies the furnishing, installing, and testing of a complete and operating Audio - Visual and Code One (Blue). Nurse Call here-in-after referred to as "the System", and associated equipment to be installed in the VA Tennessee Valley Medical Center. The System shall be capable of interfacing with the two-way radio paging system and the telephone system. The System shall be microprocessor based and include, but not be limited to: central terminal assemblies; nurse control master station; psychiatric, bedside patient, staff, staff/duty, duty, and emergency stations; dome lights; combiners, traps and filters; audio distribution amplifiers; uninterruptible power supplies (UPS); conduit, cable duct, and/or cable tray; and necessary passive devices such as, cable, wire, and connectors, cordsets, push-buttons, pillow speakers, and specialized bed connection outlets and connector cables.
- B. The System shall be delivered free of engineering, manufacturing, installation, and operating defects. It shall be engineered and installed for ease of operation, maintenance, and testing.
- C. The total System shall be designed and installed so that the installation, interfacing, integration, combining, and/or consolidation of equipment actually employed does not produce any undesirable visual or aural effects such as signal distortions, noise pulses, glitches, audio or video hum bars, transients, or ghosting.
- D. The System is defined as an Emergency Critical Care Communication System and, the Code One (Blue) System is defined as an Emergency Critical Care Life Support Communication System by the National Fire Protection Association (NFPA). Therefore, its installation and operation shall adhere to all appropriate National and Government Local Life Safety and/or Support Codes, whichever are the more stringent for this Facility. Additionally, the original equipment manufacturer's (OEM) recommendations and guidelines shall be followed. The OEM and Contractor shall ensure that all management, sales, engineering, and installation personnel have read and understand the requirements of



this specification before the System is designed, engineered, delivered, and provided.

E. The VA Project Manager (PM) and/or if delegated Resident Engineer (RE) are the approving authority for all contractual and operational changes to the System. The Contractor is cautioned to obtain in writing, approvals for System changes relating to the published contract specifications and drawings, from the PM and/or the RE before proceeding with any proposed change.

F. Equipment Standards and Product Testing:

1. All equipment and materials (other than specific nurse call or code one (blue) equipment items) used in providing the System shall be listed, labeled and certified by UL or a nationally recognized testing laboratory where such standards have been established for the utilized items. Such listing and labeling shall warrant that the equipment has been tested in accordance with, and conforms to the specified standards.
2. The provided active and passive nurse call and code one (blue) equipment required by the system design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date the technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by the VA. Where a UL standard is in existence for equipment to be used in completion of this contract, a test must be conducted to certify the equipment meet the published UL standard. This test must be conducted by UL that makes periodic inspections of the production of nurse call equipment. The Contractor's technical submittal shall include UL certification and/or documents supplied by the testing laboratory that indicate each piece of equipment to be furnished conforms to UL standards, where such standards exist:
3. Each item of equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards.
4. At a minimum, the entire system shall meet or exceed UL 1069 Standard and be listed so in UL's published literature. The Contractor shall provide a copy of the entire UL 1069 published listing as a part of the technical submittal.

- G. System Performance: The total system shall meet the following performance standards:

Function	Characteristics
Audio Gain	10 decibel (dB) minimum, Sound Pressure Level (SPL)
Signal to Noise (S/N) Ratio	35 dB minimum

## 1.2 RELATED WORK

- A. Specification Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Specification Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- C. Specification Section 16111, CONDUIT SYSTEMS.
- D. Specification Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW).
- E. Specification Section 16140, WIRING DEVICES.
- F. Specification Section 16450, GROUNDING.

## 1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. Except for a specific date given the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of the System's submittal is technically approved by the VA, shall be enforced.
- B. National Fire Protection Association (NFPA):

70	National Electrical Code (NEC)
77	RECOMMENDED PRACTICE ON STATIC ELECTRICITY
99	Standard for Health Care Facilities
101	Life Safety Code

- C. Underwriters Laboratories, Inc. (UL):

65	Standard for Wired Cabinets
467	Standard for Grounding and Bonding Equipment

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1069	Standard for Hospital Signaling and Nurse Call Equipment
1410	Standard for Television Receivers and Video Products
1778	Standard for Uninterruptable Power Supply

D. U.S. National Archives and Records Administration (NARA):

47 CFR 15	Radio Frequency Devices
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E. Electronic Industries/Telecommunications Industries Associations (EIA/TIA):

568	Commercial Building Telecommunications Wiring Standard
569	Commercial Building Telecommunications Pathways and Spaces Standard
606	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
607	Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
RS-270	Tools, Crimping, Solderless Wiring Devices Recommended Procedures for User Certification

F. Joint Commission on Accreditation of Health Care Organization (JCAHCO):  
Comprehensive Accreditation Manual for Hospitals

G. National and/or Government Life Safety Codes(s): The more stringent of each listed code.

**1.4 QUALITY ASSURANCE**

- A. The authorized representative of the System's OEM shall be responsible for the design, satisfactory total operation of the System, and its certification.
- B. The OEM shall meet the minimum requirements identified in paragraph 2.1.A. Additionally, the OEM shall have had experience with three or more installations of systems of comparable size and complexity as regards to coordinating, engineering, testing, certifying, supervising,

training, and documentation. Each of these installations shall have been in successful operation for at least three years after final acceptance by the user. These installations shall be provided as a part of the submittal identified in paragraph 1.5.

- C. The System Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The System Contractor shall be authorized by the OEM to certify and warranty the installed equipment. In addition, the OEM and System Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.
- D. The Contractor's Communications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.

#### **1.5 SUBMITTALS**

- A. Provide submittals in accordance with Specification Section 01340, SAMPLES AND SHOP DRAWINGS. The RE shall retain one copy for review and approval.
  - 1. If the submittal is approved the RE shall retain one copy for Official Records and return three (3) copies to the Contractor.
  - 2. If the submittal is disapproved, three (3) copies will be returned to the Contractor with written explanation attached indicating the areas the submittal deviated from the System specifications. The RE shall retain one copy for Official Records.
- B. Documents: The submittal shall be separated into sections for each sub-system and shall contain the following:
  - 1. Title page to include:
    - a. Facility name
    - a. VA Project Name
    - c. Contractor's name, address, and telephone (including FAX) numbers
    - d. Date of Submittal
    - e. VA Project Number

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2. A list containing a minimum of three locations of installations of similar size and complexity as identified herein. These locations shall contain the following:
  - a. Facility location and name
  - b. Owner's or User's name, address, and telephone (including FAX) numbers
  - c. Date of Project Start and Date of Final Acceptance by Owner
  - d. System Project Number
  - e. Brief (three paragraphs minimum) description of each system's function, operation and installation
3. Narrative Description of the system as it is expected to be installed.
4. A list of the equipment to be furnished. The quantity, make and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the System. Delete equipment items that are not required, add additional items required, and renumber section as per system design. List format shall be as follows:

The following are the minimum equipment required by the System:

QUANTITY	UNIT
As required	Central Terminal Equipment and Cabinet
As required	Power Amplifiers
As required	Nurse Control Master Station
As required	Staff Station
As required	Duty Station
As required	Single Patient Station
As required	Dual Patient Station
As required	Corridor Dome Lights
As required	Intersectional Dome Lights
As required	Code One Patient Station
As required	Code One Master Station
As required	Remote Annunciator Panel
As required	Wires and Cables
As required	General Station Connectors
As required	Special Bed Wall Connectors

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As required	Bath Emergency Station
As required	Emergency Station
As required	Pillow Speakers
As required	Push-button Cordsets
As required	Geriatric Cordsets
As required	Push-buttons
1 ea.	Installation Kit
As identified	Separate List of each Equipment Spare(s)

5. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
  6. Engineering drawings of the System, with information to determine compliance with contract drawings and specifications.
  7. List of test equipment per paragraph 1.5.C.
  8. Letter certifying that the Contractor understands the requirements of the SAMPLES paragraph 1.5.D.
  9. Letter certifying that the Contractor understands the requirements of Section 3.2 concerning tests.
- C. Test Equipment List:
1. The Contractor is responsible for furnishing all test equipment required to test the System in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the System. The Contractor shall furnish test equipment of accuracy better than the parameters to be tested.
  2. The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
    - a. Spectrum Analyzer
    - b. Signal Level Meter
    - c. Volt-Ohm Meter
    - d. Sound Pressure Level (SPL) Meter
    - e. Sound Pressure Level (SPL) Calibrator
    - f. Random Noise Generator
    - g. Audio Amplifier with External Speaker

- h. Pillow Speaker Test Set (Pillow Speaker with appropriate load and cross connections in lieu of the set is acceptable)
- D. Samples: A sample of each of the following items shall be furnished to the RE for approval prior to installation.
  - 1. 610 mm (2 foot) section of each cable to be used with connectors installed and OEM cable sweep compliance and/or certification tags as specified in paragraph 2.3.F.
  - 2. Back boxes for the nurse call patient stations, dome lights, staff stations, duty stations, annunciator panels, and junction boxes.
  - 3. Cover plates used for patient stations, staff stations duty stations, annunciator panels, emergency stations and code one (blue)
  - 4. UPS equipment (if required by system design).
- E. Certifications
  - 1. Submit written certification from the OEM indicating that the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.
  - 2. Submit written certification from the OEM that the wiring and connection diagrams meet National and/or Government Life Safety Guidelines, NFPA, NEC, UL 1066, this specification, and JCAHCO requirements and the instructions, requirements, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. The VA will not approve any submittal without this certification.
  - 3. Preacceptance Certification: This certification shall be made in accordance with the test procedure paragraph 3.2.B.
- F. Equipment Manuals: Ten (10) working days prior to the scheduled acceptance test, the Contractor shall deliver four (4) complete sets of commercial operation and maintenance manuals for each item of equipment furnished as part of the System to the RE. The manuals shall detail the theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams, and parts list.
- G. Record Wiring Diagrams:
  - 1. Ten (10) working days prior to the acceptance test, the Contractor shall four (4) complete sets of the record wiring diagrams of the System to the RE. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to

the markers installed on the interconnecting cables, equipment and room/area locations.

2. The record wiring diagrams shall be in hard copy and two compact disk (CD) copies properly formatted to match the Facility's current operating version of Computer Aided Drafting (AutoCAD) system. The RE shall verify and inform the Contractor of the current version of AutoCAD being used by the Facility.
  - H. Ten (10) days prior to the start of the intermediate test, provide a typewritten detailed description of the System testing plan that meets this specification's performance standards as indicated in paragraph 2.1.C including illustrations and utilizes the test equipment specified in paragraph 1.5.C. The test plan will need to be evaluated and approved by the RE before intermediate testing begins.
  - I. Provide two (2) copies of a OEM developed training video tape presentation (reference paragraph 3.3.B) for evaluation and approval by the RE.
  - J. Provide a typewritten document that details the complete record program in memory for all associated station assignments.
- PART 2 - PRODUCTS

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT AND MATERIALS**

#### **A. System Requirements:**

1. The System shall receive the specified system signals and shall process and distribute them to the designated outlet, control and/or remote locations shown on the drawings. The System shall be designed to minimize cross talk, background processor noise and other signal interference.
2. The central control equipment shall be provided in the central equipment terminal cabinet ensuring that test port(s) is provided for access to each system function without the need to disconnect distribution cables or equipment.
3. The System shall be connected to the community antenna television (CATV) cable ready television (TV) receivers in each patient room. The receivers shall be controlled remotely from the nurse call pillow speaker units in all patient rooms, as designated on the drawings. The TV Contractor will provide the proper outlets and multiconductor cables required to interface the Audio Visual Nurse Call and Code One system with the TV receivers.



4. The Nurse Call Contractor shall provide the connection from the nurse call pillow speaker remote control system to the TV remote control jack.
5. The System shall be capable of interfacing with the two way radio system and networking more than one nurse call control units. These functions and connections must be specifically approved, in writing, by the RE during the specification, and technical submittal approval processes.
6. The System shall be capable of interfacing with the telephone system and networking more than one nurse call control unit. These functions and connections must be specifically approved in writing by the RE during the technical submittal approval process.
7. Each floor or ward distribution system shall be a "buss" design where each room's nurse call equipment is fed from centrally located lateral trunk line cables. Each signal closet mounted terminal cabinet shall be capable of connection to vertical trunk line riser cables in the associated signal closet and as shown on the drawings and recommended by the OEM.
8. Each floor or ward distribution system shall be installed in conduit.
9. The Contractor shall provide verification in writing that the type wire/cable being furnished and installed is recommended and approved by the OEM and will provide a total system free of defects.
10. Central Terminal Cabinet Location: The cabinet shall be provided, protected, and located at the most central distribution system signal closet location to insure optimum origination, reception and control of all system signals. Each cabinet shall be provided with a internal active 120 Volts Alternating Current (VAC) quad receptacles connected by conduit to the Facility's Critical Branch Emergency Power Distribution Panel as shown on plans or if not shown on plans consult with RE regarding a suitable circuit location, prior to bidding. Each cabinet shall be installed to allow working clearances per NEC Article 110, paragraph 110.26 and as recommended by the equipment manufacturer. Each cabinet shall be provided, as required to meet the single audio and data channel requirements, and system performance standards.

B. Visual Nurse Call System:

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1. A System shall be provided, protected and located in the Day Hospital area. The System shall include a push-button emergency station (pull cord in Day Hospital area) with an associated corridor dome light for each patient room.
2. The System shall also include a power supply and a visual display panel at the nurse station area and as shown on the drawings. The visual display panel shall generate audible and visual emergency signals to indicate the location of a placed call.

C. Code One (Blue) System:

1. Each Intensive Care Unit (ICU), Cardiac Care Unit (CCU), Life Support Room, and Dialysis Area shall be provided with a separate code one (blue) system. This code one (blue) system shall be totally independent and separate from the nurse call system as described herein.
2. The code one (blue) system shall consist of a code one (blue) master control station with associated alarm and control units, bedside stations, duty stations, dome lights, central equipment cabinet(s), and remote annunciator panels. Local code one (blue) annunciation shall be provided at the associated nurses station, duty room(s) and staff room(s).
3. Each code one (blue) system shall be designed to provide continuous electrical supervision of the complete and entire system (i.e. dome light bulbs [each light will be considered supervised if they use any one or a combination of Underwriters Laboratory, Inc. (UL) approved electrical supervision alternates, as identified in UL-1069, 1992 revision], wires, contact switch connections, circuit boards, data, audio, and communication busses, or main and UPS power). All alarm initiating and signaling circuits shall be supervised for open circuits, short circuits, and system grounds. Main and UPS power circuits shall be supervised for a change in state (i.e. primary to backup, low battery, or UPS on line). When an open, short or ground occurs in any system circuit, an audible and visual fault alarm signal shall be initiated at the nurse control station and all remote locations.
4. Provide the System with the following minimum equipment:
  - a. Code one (blue) alarm unit with push-button/switch reset device, code one amber (or other like Life Safety approved) lamp, silencing device, test/fault alarm push-button/switch with an

- alarm lamp. The unit is to be installed at the nurse or master control station.
  - b. Local and remote annunciator panels with visual annunciators which will visually identify each unit placing a call, and a silencing device.
  - c. Code one (blue) nurse call master stations, local, and remote annunciator panels shall be capable of displaying each area that has a code one (blue) system.
  - d. Duty stations with an amber (or other like Life Safety approved) lamp, and silencing device.
  - e. Bedside stations with a push-button, amber (or other like Life Safety approved) lamp, and reset button.
  - f. Provide one single code one (blue) bedside station for each bed in the Recovery, Life Support, ICU, CCU, and Dialysis areas plus two spare stations.
  - g. A code one (blue) dome light for each bedside station equipped with an amber (or other like Life Safety approved) lamp, minimum, to identify code one bedside calls.
  - h. A code one (blue) dome light for each bedside station equipped with an amber (or other like Life Safety approved) lamp, at the foot of each bed in the Life Support, CCU, ICU units, plus one spare.
  - i. A code one (blue) corridor dome light for the Life Support and/or Step-down Bedroom.
  - j. One push-button cordset for each bed in the ICU, CCU and Dialysis, plus one spare cordset.
5. The System shall provide the following minimum operational functions that compliments and operates in conjunction with the minimum electrical or electronic supervision requirements identified in paragraph 2.H.3:
- a. Code one (blue) calls shall be cancelable at the calling station only. The code one (blue) or nurse call master station shall not have the ability to cancel code one (blue) calls.
  - b. Each code one (blue) system shall be able to receive audio calls from all bedside stations simultaneously.
  - c. Calls placed from any code one (blue) station shall generate emergency type audible and visual signals at each associated nurse control and duty station, and all local and remote

annunciator panels. Calls placed from a bedside station shall generate emergency type visual signals at the bedside station and associated dome light(s) in addition to the previous stated stations and panels.

- d. Activating the silencing device at any location, while a code one (blue) call or system fault is occurring shall mute the audible signals at the alarm location. The audible alarm shall regenerate at the end of the selected time-out period until the call or fault is corrected. The visual signals shall continue until the call is canceled and/or a fault is corrected. When the fault is corrected, all signals generated by the fault shall automatically cease, returning the System to a standby status. Audible signals shall be regenerated in any local or remote annunciator panel that is in the silence mode, in the event an additional code (blue) one call is placed in any code one (blue) system. The additional code one (blue) call shall also generate visual signals at all annunciators to identify the location of the call.
6. It is permissible to utilize an audio visual microprocessor nurse call system for code one (blue) functions providing the System is designed and UL approved to function as an integrated nurse call and code one (blue) system that employs code one (blue) operational qualities as described herein for all system locations, and equipped with the following functions and capabilities, at a minimum:
  - a. A bedside station must be able to place a code one (blue) call in addition to, and at the same time, a regular nurse call is placed, or be provided with a code one (blue) station separate from the nurse call bedside station.
  - b. Must be able to generate audible and visual signals to code one (blue) duty stations, local and remote annunciating panels as specified herein for code one (blue) placed calls.
  - c. Possess built-in diagnostics to locate and service components.
  - d. Perform continuous electrical supervision circuitry as defined in herein for code one (blue) and associated nurses call functions.

D. General:

1. All equipment to be supplied under this specification shall be new and the current model of a standard product of an OEM of record. An OEM of record shall be defined as a company whose main occupation is

the manufacture for sale of the items of equipment supplied and which:

- a. Maintains a stock of replacement parts for the item submitted.
  - b. Maintains engineering drawings, specifications, and operating manuals for the items submitted.
  - c. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.
2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity or performance characteristics of items furnished in the System. When the Contractor furnishes an item of equipment for which there is a specification contained herein, that item of equipment shall meet or exceed the specification for that item of equipment.
  3. The Contractor shall provide written verification, to the RE that the type of wire/cable being provided is recommended and approved by the OEM. Cabling shall meet the interconnecting wiring requirements of UL 1069; and the requirements of NFPA 70 (NEC). The Contractor is responsible for providing the proper size and type of cable duct and/or conduit and wiring even though the actual installation may be by another subcontractor.
  4. The Nurse Call Contractor is responsible for interfacing the RED, MATV and Telephone with the nurse call system. The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. At a minimum, an acceptable interfacing method, requires not only a physical and mechanical connection but, a matching of signal, voltage and processing levels, with regard to signal quality and impedance. The interface point must adhere to all standards described herein for the full separation of Critical Care and Life Safety systems. The audio interface must be accomplished utilizing solid state switching. It is not acceptable to utilize the MATV/cable system for distribution and control of RED and nurse call system signals and equipment.
  5. The TV multi-pin jack shall be the interface point for connection of the nurse call cabling from the bedside station. The multi-pin jack and MATV outlet with cover plate shall be furnished and installed by the MATV Contractor. The Nurse Call Contractor shall provide and

- interface the nurse call pillow speaker TV remote control functions to the MATV multi-pin jack.
6. Active electronic component equipment shall consist of solid state components and be rated for continuous duty service in the areas where provided.
  7. All passive distribution equipment and cables shall meet or exceed - 80 dB radiation shielding specifications.
  8. All signaling and communication circuits shall be solid state except for audio switching relays.
  9. The System shall utilize microprocessor components for all signaling and programming circuits and functions. Program memory shall be non-volatile or protected from erasure from power outages for a minimum of five minutes.
  10. The System shall provide the continuous polling (not to be substituted for electrical supervision) of each station sequentially to determine change of status and to assist in trouble shooting faults.
  11. All voltages, except for the primary power to the power supply circuits, shall not exceed 30 VAC Root Mean Squared (RMS) or 41.2 V direct current (DC).
  12. Color code all distribution wiring to conform to the Nurse Call Industry standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance.
  13. Connect the System's primary input AC power to the Facility's Critical Branch of the Emergency AC Power Distribution System as shown on plans or if not shown on plans consult with RE regarding a suitable circuit location, prior to bidding.
  14. Provide a UPS for the System to operate and function normally (as if there was no AC power failure) in the event of an AC power failure for a minimum of 15 minutes.
  15. All equipment shall function and operate normally from the furnished power source, and also, during input power fluctuations or loss of power for a minimum of 15 minutes.
  16. Plug-in connectors shall be provided to connect all stations, except emergency stations and corridor lights. Emergency stations and

corridor lights shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed with a ratchet type installation tool are an acceptable alternate as long as the cable dress, pairs, shielding, grounding, and connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts or solder type connections are unacceptable and will not be approved.

17. All equipment face plates utilized in the System shall be stainless steel, anodized aluminum or UL approved cycolac plastic that matches the equipment item it is installed. All faceplates shall be constructed of the same material throughout the facility.
  18. All equipment trim plates utilized in the System shall be stainless steel, anodized aluminum or UL approved cycolac plastic that matches the equipment item and the areas where provided. Trim plates are not authorized to bear the UL label for the station unless specifically approved by UL. All trim plates shall be constructed of the same material throughout the facility.
  19. Noise filters and surge protectors shall be provided for each equipment control cabinet, nurse call master station, local, and remote locations to ensure protection from input primary AC power surges and noise glitches are not induced into low voltage data circuits.
  20. Passive and electronic components and cabling shall be provided under the OEM's recommendations and guidance, to prevent damage to any system equipment from electrostatic discharges of a minimum of 25,000 Volts, at a relative humidity of a maximum of 20 percent (%) or less. The Contractor shall detail in the technical submittal the method and equipment to be utilized to protect the system components from a minimum 25,000 Volt electrostatic discharge.
- E. Patient Bedwall Equipment shall include, but not be limited to, the following:
1. One pillow speaker and cordset shall be provided for each patient bed in Observation and Treatment Nursing Units. Provide one spare for each 40 beds or portion thereof.
  2. Provide one dummy plug for each bedside station. Provide 10% spare dummy plugs.
  3. One single or dual audio-visual bedside station shall be provided for each bed in the nursing units listed in paragraph 1.1.E. Provide

one spare for each 40 single bedside station and portion thereof. Plus, provide one spare for each 40 dual bedside stations, and portion thereof.

4. One visual bedside station shall be provided for each ICU bed. Provide two spare stations.
5. One specialized wall connector and interface cable shall be provided to connect each special hospital treatment bed used by the Facility at each patient bed location and as shown on the drawings. Provide one spare connector and interface cable for each 40 bedside locations, and portion thereof. Note: Contact the Facility's Engineering, Nursing and Contracting Services to determine proper type of connector to be used.

F. Master Station Nurse Call and Code One (Blue) Equipment shall include, but not be limited to, the following:

1. Provide one station, including cathode ray tube (CRT), computer processing unit (CPU), keyboard, mouse, and UPS when used, per nurse station. Provide two complete spare stations that at a minimum include CRTs, CPUs, keyboards, mouse, and UPS's when used.
2. One telephone type handset shall be provided per station. Provide two spare handsets.
3. Provide one current (as of the technical acceptance date of the System by the VA) operational copy of system software (VA to retain right of ownership and to be provided future software upgrades at a negotiated cost). Provide one complete spare software copy including published and unpublished upgraded.

G. Dome Lights:

1. Corridor dome lights shall be provided as shown on the drawings and identified in the equipment list. Provide one spare dome light for each 40 locations, and portion thereof.
2. Room dome lights shall be provided as shown on the drawings and identified in the equipment list. Provide one spare dome light for each 40 locations, and portion thereof.
3. Code one (blue) dome lights shall be provided as shown on the drawings and identified in the equipment list. Provide one spare dome light for each 40 locations, and portion thereof.



H. Local and Remote Annunciator Panel Equipment shall be provided in the locations shown on the drawings and identified in the equipment list. Provide one spare panel.

I. Equipment Functional Characteristics:

FUNCTIONS	CHARACTERISTICS
Input Voltage	105 to 130 VAC
Power Line Frequency	60 Hertz (Hz), $\pm 2.0$ Hz
Operating Temperature	0 to 50 degrees ( $^{\circ}$ ) Centigrade (C)
Humidity	80 %, minimum rating

## 2.2 CENTRAL TERMINAL ASSEMBLIES

A. Equipment Cabinet:

1. The provided equipment cabinet shall be lockable, fabricated of heavy gauge steel with baked on paint finish. The color shall conform to the area in which it is installed and approved by the RE. It shall be wall mounted with knockout holes for cable entrance and conduit connection, contain ventilation ports and quiet fan with non-disposable air filter for equipment cooling. Two keys shall be provided to the RE for each lock when the VA accepts the System.
2. AC Power Surge Protector Strip(s):
  - a. The strip may be provided, in lieu of the required internal cabinet mounted quad AC outlet(s), with an outlet for each item of equipment and a minimum of four spare AC power outlets. Each strip shall be mounted inside and at the rear of each equipment cabinet. The strip shall be self-contained in a metal enclosure with a maximum of 1.8 m (6 feet) connecting wire with three-prong plug. It is acceptable to connect it to one of the service outlets for the AC power line filter. Extension or "pig tail" non-protected cords from the system cabinet or rack to a system wall outlet is not authorized and shall not be allowed and if discovered shall be grounds to declare the entire system unacceptable and terminate all acceptance testing.

b. Technical Characteristics:

Power Capacity	20 Ampere (AMP), 120 VAC continuous duty
Wire Gauge	Three conductor, #12 American Wire Gauge (AWG) solid copper

3. AC Power Line Surge Protector and Filter:

- a. Provide each cabinet containing active electronic equipment shall be with a AC surge protector and filter. The protector and filter shall be housed in one single enclosure. The protector and filter shall provide instantaneous regulation of the AC input voltage and isolate and filter any noise present on the AC input line. It shall be mounted inside the cabinet and the cabinet's AC power strip (two strips maximum) may be connected to it.

b. Technical Characteristics:

Input Voltage Range	120 VAC $\pm$ 15%
Power Capacity	20 Amperes (AMP), 120 VAC
Voltage Output Regulation	$\pm$ 3.0%
Circuit Breaker	15 AMP, may be self contain
Noise Filtering	Greater than 45 dB
AC Outlets	Four duplex grounded types, minimum
Response Time	5 Nano Seconds (nS)
Surge Suppression	10,000 AMPS
Noise Suppression:	
Common	-40 dB
Differential	-45 dB

B. Central Terminal Equipment:

- Each sub-system (ward) shall be provided with separate central terminal equipment that will service no more than two nursing units or wards. Components of the central equipment shall be mounted on panels or standard EIA rack dimensions.
- The provided sub-systems shall be balanced so that when the system volume level is adjusted to maximum, no pulsating noise or data

noise is audible, when communicating between the nurse control station and the most distant patient bedside station.

3. Each power amplifier unit shall be provided with separate power overload protection circuits and shall provide self-limiting audio compression without distortion. The amplifiers shall have a common volume control for regulation of intercom audio for all associated stations. The amplifiers shall be adjusted/balanced to provide normal system audio levels between the master station and all remote locations when system audio levels are adjusted to approximately mid-range. Provide one spare amplifier circuit board and/or module.
4. Each provided cabinet shall conform to the spaces designated for installation. The width, height and depth dimensions of the central equipment cabinet shall be included with the equipment submittals.

### **2.3 EQUIPMENT SPECIFICATIONS**

#### **A. Nurse Call Bedside Station:**

1. Each single bedside station shall be provided with a microphone/speaker, call answered/monitor lamp, call placed annunciator lamp, reset/cancel button and a receptacle for cordset.
2. Each single and dual bedside station microphone/speaker audio output shall be muted when the pillow speaker is plugged into the bedside station. Single bedside stations shall be mounted on a four-gang back box, minimum. A trim plate constructed of stainless steel or a material similar to the bedside station shall be provided to cover the back box opening and frame the cover plate.
3. Where dual bedside stations are required, each station shall be provided with two cordset receptacles, two call place annunciator lamps, and at least one of all the other single station features enumerated in the preceding paragraph concerning single bedside stations. Dual bedside stations shall be mounted on a six-gang back box, minimum. A trim plate constructed of stainless steel or a material similar to the bedside station shall be provided to cover the back box opening and frame the cover plate.
4. Two beds on a common bedroom wall shall be provided with one staff station. Each staff station shall be mounted on a six-gang back box, minimum. A trim plate constructed of stainless steel or a material similar to the staff station shall be provided to cover the back box opening and frame the cover plate.

5. Placement of a call at the bedside station shall generate routine placed call visual signals in the corridor dome light.
- B. Staff Station: Each staff station shall be provided with:
1. Two-way voice communication with the nurse control master station.
  2. A call origination device, cancel device, placed call annunciator, and an incoming call/privacy annunciator indicator.
  3. A connection from the on-call room to the nurse control master station.
  4. Each staff station shall be mounted on a six-gang back box, minimum. A trim plate constructed of stainless steel or a material similar to the staff station shall be provided to cover the back box opening and frame the cover plate.
- C. Staff/Duty Station: Each staff/duty station shall be provided with:
1. Two-way voice communications with the nurse control master station.
  2. A call placed annunciator and a device to generate audible signals.
  3. A call origination device, call placed annunciator, cancel device, and incoming call/privacy annunciator indicator.
  4. The capability to indicate all patient normal calls placed in the System with audible and visual signals.
  5. The capability to indicate all patient/emergency calls with audible and visual signals.
  6. Each staff/duty station shall be mounted on a six-gang back box, minimum. A trim plate constructed of stainless steel or a material similar to the staff/duty station shall be provided to cover the back box opening and frame the cover plate.
- D. Emergency Station:
1. A pullcord emergency station shall be provided in each toilet stall and each shower/bath stall, one per shower head. Shower emergency stations shall be provided inside the shower stall at the shower headend. They shall be provided approximately 460 mm (18 inches) from the shower head itself and/or 1830 mm (72 inches) above finished floor (AFF). Each station inside shower and toilet areas shall be equipped with a rubber gasket between the face plate and wall or be rated by UL as waterproof.
  2. The gasket shall cover and water seal the entire back box opening and not extend beyond the sides of the associated face plate by 6.4 mm (1/4 inch) maximum. If the wall is tile or other uneven type

- material the gasket and associated face plate shall be provided to completely seal the opening and uneven material surface.
3. Each emergency station shall be mounted on a double-gang back box, minimum. A trim plate constructed of stainless steel or a material similar to the emergency station shall be provided to cover the back box opening and frame the cover plate.
  4. Emergency stations shall be provided with:
    - a. A ten-pound test pull cord and pendant which shall be connected to a positive action on/off switch at the emergency station. The cord with pendant shall terminate 150 mm (6 inches) AFF.
    - b. A minimum of one pound pull to activate the switch.
    - c. A reset/cancel function on the face plate of the emergency station.
    - d. "EMERGENCY NURSE CALL" or similar approved wording stamped or permanently affixed on the face plate. The emergency wording letters shall be a minimum of 3.2 mm (1/8 inch) high.
    - e. A red lamp which shall flash at a rate of one second on and one second off upon initiation of a call from the emergency station. The lamp shall continue to flash until the station is reset.
- E. Corridor Door Dome Lights:
1. Provide light covers that are translucent and shall not deform, discolor or craze from heat or use of normal hospital cleaning agents.
  2. Corridor door dome lights shall be provided for patient bedrooms and shall contain sufficient lamps to permit distinguishing the following type placed calls:
    - a. Routine placed calls from bedside stations
    - b. Emergency placed calls from bath/toilet emergency stations, if the bedroom has such facilities
    - c. Emergency placed calls from bedside stations that are programmed in the emergency/priority mode
    - d. The visual signals for routine and emergency/priority placed calls shall be distinctly different from each other
    - e. Calls placed in the reminder/nurse aide function.
  3. Corridor dome lights shall be provided for congregate bath/toilet areas and shall contain one red lamp.
  4. Each dome light shall be mounted on a dual-gang back box, minimum. A trim plate constructed of stainless steel or a material similar to

the dome light shall be provided to cover the back box opening and frame the cover plate.

F. Nurse Control Master Station: Each nurse control station shall be provided:

1. As an audiovisual type.
2. As desk mounted: With 1.2 meters (4 feet) of interconnecting cable (from the central equipment to the master station) to allow for convenient placement of the nurse control station on the desktop.
3. With the following features:
  - a. Microphone/speaker and telephone handset with a 910 mm (3 foot) coiled cord. The handset shall be able to conduct two-way voice communication between the nurse and the selected calling station. Lifting the handset shall mute the microphone/speaker.
  - b. Digital readout touch screen to visually announce the location of incoming calls placed in the System including room and bed number and priority of the call. Identify each calling station with an individual display, including separate displays for each patient sharing a dual bedside station. If a digital readout touch screen standard is not submitted or approved by the Facility during the project design phase, an alpha - numeric scheme shall be provided that identifies the: ward, room and bed (i.e. Ward 2a, Room 201, Bed A (or 1) shall read 2A201A -or- 2A201-1. Equivalent readouts are acceptable as long as the Facility approves the readout).
    - 1) Calls placed at emergency stations located in toilets and baths inside bedrooms shall be displayed for the bed closest to the nurse control station. Beds in multi-bed bedrooms shall be identified in a clock-wise pattern upon entering the bedroom.
    - 2) It shall display a minimum of four incoming calls. Additional placed calls shall be stored in order of placement and priority.
  - c. Nurse follower function. All calls placed in the System shall be visually or audibly announced at the selected bedside stations when selecting the nurse follower mode of operation and the bedside stations to be visited. It is acceptable for the nurse follower mode to be activated inside rooms containing bedside stations.
  - d. Automatic answering function or selective answering device.

- e. Incoming call priority function. The visual or audible signals shall indicate if a routine or emergency (and/or code) call has been placed and shall continue until the call is canceled. The emergency calls shall be capable of being canceled only at the originating station. Provide for the programming to two levels of priority, minimum, for incoming calls from each associated bedside station.
- f. Reminder function. Shall temporarily store a placed call and generate visual signals in the corridor dome light associated with the calling bedside station by activating the reminder function/circuitry. The visual signals shall terminate and the stored call is eliminated from memory when the call is canceled at the originating station.
- g. The ability to generate visual and audible signals to indicate incoming calls from associated stations which:
  - 1) Shall silence or attenuate the audible signals through muting/attenuation circuits while the control station is being used to answer or place a call. The audible signals for incoming calls not answered shall be automatically reenergized when the nurse control station is returned to the standby mode.
  - 2) The visual signals for incoming calls shall remain displayed at all times until each call is answered or canceled at the calling station.
  - 3) The visual and audible signals for routine and emergency calls shall be distinctly different. The audible signals shall be generated at the same rate as the corresponding visual signals for each emergency calls. Audible signals for routine calls shall be generated at the same rate as the visual signals, or by repeating an audible signal every five to ten seconds until the call is answered or canceled.
  - 4) The visual display to indicate the location of a placed call shall appear on the control station within two seconds, maximum, after initiation of a call.
- h. Touch pad, or equal, to permit the nurse to selectively place calls to and conduct two-way voice communication with, all system bedside, staff and duty stations and associated nurse stations. The touch pad shall also provide for the programming of priority

status and any other function capable of being programmed from the nurse control station.

- i. The ability to monitor a bedside station. The wiring and/or equipment used shall assure that, when a station is being monitored or called by the nurse control station, the call answered/monitor lamp station shall be lighted.
  - j. The capability of paging a minimum of 10 bedside stations simultaneously.
  - k. The ability to receive calls from a minimum of 10 associated stations simultaneously.
  - l. The ability for answering placed calls by either:
    - 1) Picking up the handset or by activating an answer next call function, which will automatically permit the nurse to communicate with the station that is next in sequence of placed calls by priority and time of placement, or
    - 2) By being able to selectively answer any placed call displayed in the order of priority and time of placement.
  - m. Accommodate a minimum of 10 percent expansion of additional patient, emergency, staff and duty stations within each master nurse control station as installed without any additions to the central equipment.
  - n. Nurse control master stations that require AC power and/or have video type (or CRT) display units associated with them, shall be connected to the same Emergency Critical Care Distribution System AC power panel that supplies AC power to its associated central terminal cabinet. A UPS shall be provided at the nurse station location to supply battery back up power to the station and CRT equipment if they are not powered from the central terminal equipment battery backup system.
- G. Cordsets: Cordsets shall be designed for medical gas environments.
1. General - each cordset cable shall be provided with:
    - a. 1.8 m or 2.4 m (6 or 8 foot) long, heavy-duty, flexible cable.
    - b. A non-corrosive, non-tarnishing metal or molded composition clip. The clip shall be used to fasten the cordset to sheets or blankets without tearing or damage to the sheet/blanket material. Do not attach the clip to a PBPU unless the RE has received written permission from the PBPU OEM directing the acceptable method of attachment.



- c. When a cordset is disconnected, an emergency call shall automatically be initiated to the nurse control and duty stations. The audible and visual signals shall remain activated until the cordset is reinserted or a dummy plug or other technically approved devices shall be provided that will deactivate the automatic call feature when pillow speakers are removed. It is acceptable that dummy plugs be equipped with a push-button or other device to place calls when substituted for a pillow speaker or cordset.
  - d. The ability to place a call by applying a minimum of one pound of pressure on the envelope.
  - e. Shall not discolor as a result of exposure to medical or sterilization gas.
2. Cordsets with Momentary Action Push-buttons: Each cordset shall be provided:
- a. And designed for connection to the bedside station cordset receptacle.
  - b. With and contain a momentary action call originating button on the end of the cordset.
3. Geriatric Cordsets: Each cord shall be provided with a soft, molded plastic or rubber envelope, attached on the end of the cordset.
- H. Pillow Speaker: Each pillow speaker shall be designed for non-medical gas environments (unless specific technical approval is granted by the RE on a case by case basis) and provided with the following features:
- 1. A momentary action push-button for signaling the nurse and permitting two-way voice communication between the patient and the nurse, through the pillow microphone/speaker.
  - 2. Constructed of a high impact molded composition, bear the UL label either molded into the outside of the unit or a separate UL label affixed inside the unit, and contain a plug which shall permit only one method of connection to the bedside station receptacle.
  - 3. Shall not discolor as a result of exposure to medical or sterilization gas.
  - 4. When a pillow speaker is disconnected, an emergency call shall automatically be initiated to the nurse control and duty stations. The audible and visual signals shall remain activated until the pillow speaker is reinserted or a dummy plug or other technically approved devices shall be provided that will deactivate the

- automatic call feature when pillow speakers are removed. Dummy plugs shall be equipped with a push-button or other device to place calls.
5. Contain a holder for storage of each pillow speaker when speaker is not in use. The use of a magnet or cordset clip to store the pillow speaker on the bedside station instead of a holder is not acceptable. Do not attach the holder to a PBPU unless the RE has received written permission from the PBPU OEM directing the acceptable method of attachment.
  6. Shall have a control for selecting four channels of radio entertainment and television audio, with an on/off selection and volume control associated with the entertainment systems. The microphone/speaker shall have a minimum frequency response of 500-4500 Hz.
  7. The controls for placing nurse calls and selection of TV and radio channels shall be provided on the face of the pillow speaker microphone and shall be clearly labeled.
    - a. Shall have a control for changing television channels.
    - b. Shall have a separate control, including separate volume stepper, for selection of RED audio for each pillow speaker. The control shall have a function point for each active audio channel (four channels minimum) and one off function point.
    - c. Shall permit radio and television audio to be heard through the pillow microphone/speaker.
    - d. Shall automatically mute entertainment audio when calls are placed or answered at the nurse control station.
    - e. Shall mute entertainment audio when the master control station is placed on the monitor position for an individual bedside station.
  8. Shall withstand a drop of 1520 mm (5 feet) to a hard surfaced floor without damage to any internal component or housing.
  9. The ability to place a call by applying a minimum of one pound of pressure on the envelope.

#### **2.4 DISTRIBUTION SYSTEM**

- A. Refer to Specification Section 16742 for additional VHA wire and cable standards and installation requirements. Each wire and cable used in the System shall be specifically OEM certified by tags on each reel and recommended and approved for installation in the Facility. The Contractor shall provide the RE a 610 mm (2 foot) sample of each wire and/or cable

actually employed in the System and each certification tag for approval before continuing with the installation as described herein.

## **2.5 INSTALLATION KIT**

The kit shall be provided that at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, and bolts required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or wiring block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the COTR all unused and partially opened installation kit boxes, coaxial cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. This is an acceptable alternate to the individual spare equipment requirement as long as the minimum spare items are provided in this count. The following are the minimum required installation sub-kits:

### **A. System Grounding**

1. The grounding kit shall include all cable and installation hardware required. All A/V nurse call equipment shall be connected to earth ground via internal building wiring, according to the NEC.
2. This includes, but is not limited to:
  - a. Coaxial Cable Shields
  - b. Control Cable Shields
  - c. Data Cable Shields
  - d. Equipment Racks
  - e. Equipment Cabinets
  - f. Conduits
  - g. Cable Duct
  - h. Cable Trays
  - i. Power Panels
  - j. Connector Panels

B. Coaxial Cable (MATV Interconnections): The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, and clamps required to accomplish a neat and secure installation.

C. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, wiring blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, and labels required to accomplish a neat and orderly installation.

- D. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
- E. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface Systems and sub-systems according to the OEM requirements and this document.
- F. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each sub-system according to the OEM requirements, record drawings, and this document.
- G. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Product Delivery, Storage and Handling
  - 1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name, equipment model and serial identification numbers, and UL logo. The RE may inventory the nurse call equipment at the time of delivery and reject items that do not conform to this requirement.
  - 2. Storage and Handling: Store and protect equipment in a manner that will preclude damage as directed by the RE.
- B. System Installation
  - 1. Do not install nurse call and fire alarm systems in the same conduit, raceway or cable trays.
  - 2. For VA Facilities, it is permissible to include non-powered RED and MATV cables with nurse call cables provided each signal is directly controlled by its system and each cable is 100% shielded and bundled as described herein.
  - 3. The Contractor shall provide suitable filters, traps and pads for minimizing interference and for balancing the amplifiers and distribution system(s). Items used for balancing and minimizing

interference shall be able to pass audio, data and control signals in the speeds and frequency bands selected, in the directions specified, with low loss, and high isolation and with minimum delay of the system poling or subcarrier frequency(s).

4. Back up power supplies (e.g., batteries, UPS) shall be installed in the central equipment cabinet or in a separate metal cabinet equipped with a hinged door and lock. If a separate cabinet is installed, it shall be provided adjacent to the central equipment cabinet. Where the backup power supply is already self-contained in a housing, the unit can be mounted adjacent to the respective equipment cabinet. In all cases, backup power supplies must be permanently mounted. Each UPS and/or backup power supply shall be provided with full electrical supervision as described herein.
5. When prefabricated bedside units (PBPU) are used in the System, the Contractor shall contact the RE who in turn will contact the PBPU OEM to obtain proper authorizations and written certifications to attach system components to the PBPU in locations where standard PBPU access, port knockouts or routes have not been provided. Additionally, if the patient pillow speaker or cordset hanger does not have a standard place or mode of attachment to the PBPU, the Contractor shall obtain the aforementioned guidance from the PBPU OEM for attaching the hanger. Under no circumstance shall the Contractor modify, drill, punch, or proceed with installation of the System in PBPU's without the required approvals.
6. In those areas where special beds are to be used and the communications connected to the PBPU or to the headwall, the PBPU, nurse call, and the bed OEMs shall be contacted by the COTR to secure the proper authorizations and guidance for interfacing the bed's communications systems with the System.
7. All passive equipment shall be connected according to the OEM's specifications to insure correct termination, isolation, impedance match, and signal level balance at each speaker.
8. Install all equipment for each location specified herein and as identified on the drawings.
9. All trunk, distribution and interconnecting lines shall be terminated in a suitable manner to facilitate future expansion of the System by adding center terminal equipment only.

10. All vertical and horizontal lines shall be terminated so that subsequent expansion for additional audio channels shall require modifications of the System central terminal equipment only.
  11. Terminating resistors shall be used to terminate all unused branches, outlets, unused equipment ports of the System and shall be devices designed for the purpose of terminating audio cables carrying audio signals in nurse call systems.
- C. Conduit and Signal Ducts:
1. Conduit:
    - a. The Contractor shall employ the latest installation practices and materials. The minimum conduit size shall be 25 mm (1 inch) in diameter for primary signal distribution and 19 mm (3/4 inch) for remote connections (i.e. dome lights, emergency station, TV control, or RED control).
    - b. All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow nurse call cables to be installed in partitioned cable tray with RED and MATV cables, shall be granted in writing by the RE if requested.) The mixing of nurse call and fire alarm cables and/or systems is not authorized and will not be approved. (See caution identified in paragraph 3-1b.3.e.). Conduit shall be provided in accordance with Specification Section 16111, CONDUIT SYSTEMS, at a minimum.
    - c. Conduit fill shall not exceed 40 percent.
    - d. Cable runs shall be splice free between conduit junction and interface boxes and equipment locations.
  2. Signal Duct, Cable Duct, or Cable Tray:
    - a. The Contractor shall use existing signal duct, cable duct and/or cable tray, when identified and approved by the RE.
    - b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 inch x 4 inch) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides, or barriers are required on all sharp corners, openings, anchors, bolts, or screw ends, junction, interface and connection points.
    - c. Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and UL certified and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.

- d. Do not pull wire or cable through any box, fitting or enclosure where change of approved conduit, cable tray, signal, or cable duct alignment or direction occurs. Ensure the proper bend radius is maintained for each wire or cable as specified by it's OEM.
- e. Employ temporary guides, sheaves, rollers, and other necessary items to protect the wire or cable from excess tension or damaging bending during installation. Abrasion to wire or cable jackets is not acceptable and will not be allowed. Replace all cables whose jackets have been abraded. The discovery of any abraded and/or damaged cables during the proof of performance test shall be grounds for declaring the entire system unacceptable and the termination of the proof of performance test. Completely cover edges of wire or cable passing through holes in chassis, cabinets or racks, enclosures, pull or junction boxes, or conduit with plastic or nylon grommetting.
- f. All cable junctions and taps shall be accessible. Do not install junction blocks, multi distribution connections or other distribution equipment (active or passive) items inside signal ducts. Use a 150 mm x 150 mm x 100 mm (6 inch x 6 inch x 4 inch) minimum covered junction box attached to the signal duct fixed side for distribution system passive equipment installation. Ensure all equipment and connection assembly junctions are accessible.

D. Distribution System Signal Wires and Cables

- 1. Wires and cables shall be provided in the same manner and use like construction practices as Fire Protective and other Emergency Systems that are identified and outlined in NFPA 101, Life Safety Code, Chapters 7, 12, and/or 13, NFPA 70, National Electrical Code, Chapter 7, Special Conditions. The wires and cables shall be able to withstand adverse environmental conditions location without deterioration. Wires and cables shall enter each equipment enclosure, console, cabinet, or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of the cables.
- 2. Routing and Interconnection:
  - a. Wires or cables routed between consoles, cabinets, racks, and other equipment shall be installed in an approved conduit, signal

- duct, cable duct, or cable tray that is secured to building structure.
- b. Wires and cables shall be insulated to prevent contact with signal or current carrying conductors and be 100% shielded. Wires or cables used in assembling consoles, panels, equipment cabinets and racks shall be formed into harnesses that are bundled and tied. Harnessed wires or cables shall be combed straight, formed and dressed in either a vertical or horizontal relationship to equipment, controls, components or terminations.
  - c. Harnesses with intertwined members are not acceptable. Each wire or cable that breaks out from a harness for connection or termination shall have been tied off at that harness or bundle point, and provided with a neatly formed service loop.
  - d. Wires and cables shall be grouped according to service (i.e.: AC, grounds, signal, DC, or control). DC, control and signal cables may be included with any group. Wires and cables shall be neatly formed and shall not change position in the group throughout the conduit run. Wires and cables in approved signal duct, conduit, cable ducts, or cable trays shall be neatly formed, bundled and tied off in 600 mm to 900 mm (24 to 36 inch) lengths and shall not change position in the group throughout the run. Concealed splices are not allowed.
  - e. Separate, organize, bundle, and route wires or cables to restrict channel crosstalk or feedback oscillation inside any enclosure. Looking at any enclosure from the rear (wall mounted enclosures, junction, pull or interface boxes from the front), locate AC power, DC, and speaker wires or cables on the left; coaxial, control, microphone, and line level audio and data wires or cables, on the right. This installation shall be accomplished with ties and/or fasteners that will not damage or distort the wires or cables. Limit spacing between tied off points to a maximum of 150 mm (6 inches).
  - f. Distribution cables shall be installed and fastened without causing sharp bends or rubbing of the cables against sharp edges. Cables shall be fastened with hardware that will not damage or distort them.
  - g. Cables shall be labeled with permanent markers at the terminals of the electronic and passive equipment and at each junction



point in the System. The lettering on the cables shall correspond with the lettering on the record diagrams.

- h. Completely test all of the cables after installation and replace any defective cables.
- i. Provide system input and output polarity as recommended by the OEM. Insure each color coded wire or cable is connected and terminated to maintain system polarity to be at least the same quality of professional audio systems. Reflect all color codes, wire and cable terminations on the System's record drawings as required herein.

E. Outlet Boxes, Back Boxes, and Face Plates

- 1. Outlet Boxes: Signal, power, interface, connection, distribution, and junction boxes shall be provided as required by the system design, on-site inspection, and review of the contract drawings.
- 2. Back Boxes: Back boxes shall be provided as directed by the OEM as required by the approved system design, on-site inspection, and review of the contract drawings.
- 3. Face Plates (or Cover Plates): Face plates shall be of a standard type, stainless steel, anodized aluminum or UL approved cyclac plastic construction and provided by the Contractor for each identified system location. Connectors and jacks appearing on the face plate shall be clearly and permanently marked.

F. Connectors: Circuits, transmission lines and signal extensions shall have continuity, correct connection, and polarity. Polarity shall be maintained between all points in the System.

1. Wires:

- a. Wire ends shall be neatly formed and where insulation has been cut, heat shrink tubing shall be employed to secure the insulation on each wire. Tape of any type is not acceptable and will not be approved.
- b. Audio spade lugs shall be installed on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips. AC barrier strips shall be provided with a protective cover to prevent accidental contact with wires carrying live AC current. Wiring blocks are approved for signal, not AC wires. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.

2. Cables: Each connector shall be designed for the specific size cable being used and installed with the OEM's approved installation tool. Typical system cable connectors include, but are not limited to: Audio spade lug, wiring block, and wirewrap.

G. AC Power: AC power wiring shall be run separately from signal cable.

H. Grounding

1. General: The Contractor shall ground all Contractor installed equipment to eliminate all shock hazard and to minimize, to the maximum extent possible, all ground loops, common mode returns, noise pickup, and crosstalk. The total ground resistance shall be 0.1 Ohm or less:
  - a. Under no conditions shall the AC neutral, either in a power panel or in a receptacle outlet, be used for system control, subcarrier or audio reference ground.
  - b. The use of conduit, signal duct, or cable trays as system or electrical ground is not acceptable and will not be permitted. These items may be used only for the dissipation of internally generated static charges [not to be confused with externally generated lightning] that may be applied or generated outside the mechanical and/or physical confines of the System to earth ground. The discovery of improper system grounding shall be grounds to declare the System unacceptable and the termination of all system acceptance testing.
2. Cabinet Buss: A common ground buss of at least #10 AWG solid copper wire shall extend throughout each equipment cabinet and be connected to the system ground. Provide a separate isolated ground connection from each equipment cabinet ground buss to the system ground. Do not tie equipment ground busses together.
3. Equipment: Equipment shall be bonded to the cabinet ground bus with copper braid equivalent to at least #12 AWG. Self grounding equipment enclosures, racks or cabinets, that provides OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternates.
4. Cable Shields: Cable shields shall be bonded to the cabinet ground buss with #12 AWG minimum stranded copper wire at only one end of the cable run. Cable shields shall be insulated from each other, face plates, equipment racks, consoles, enclosures or cabinets; except, at the system common ground point. Coaxial and audio cables,

shall have one ground connection at the source; in all cases, cable shield ground connections shall be kept to a minimum.

I. Equipment Assembly:

1. Cabinets:

- a. Each enclosure shall be: floor or wall mounted with standard knockout holes for conduit connection or cable entrance; provide for ventilation of the equipment; have front and rear locking doors (except wall mounted cabinets that require only a front locking door); power outlet strip(s) and bulkhead connector panel(s).
- b. Each cabinet shall be equipped with a quiet fan and nondisposable air filter.
- c. Enclosures shall be installed plumb and square. Each shall be permanently attached to the building structure and held firmly in place as approved by the RE.
- d. Signal equipment, patch or bulkhead connector panels (i.e.: audio, data, or control) shall be connected so that output for from each source, device or system component shall enter the panel at the top row of jacks, beginning left to right as viewed from the front, which will be called "input". Each connection to a load, device or system component shall exit the panel at the bottom row of jacks, beginning left to right as viewed from the front, which will be called "output".

J. Labeling: Abbreviations may be used as long as they are symbol(s) or acronyms designated for the System or equipment by accepted industry standards and each abbreviation is used on the appropriate system and sub-system "record" drawing.

1. Cable and Wires (Hereinafter referred to as "Cable"): The Contractor shall install labels on all cables at each side of all connections. The labeling shall be permanent, with contrasting identification alpha or numeric, identifying each cable according to the System "as record" drawings. Labels shall be installed adjacent to each mechanical connector, pull box or break in the cable run.
2. Equipment: The Main Nurse Call Control Panel, amplifying, control, switching, and routing equipment inputs and outputs shall be permanently labeled with contrasting plastic laminate or bakelite material. System equipment shall be permanently labeled on the face of the unit corresponding to its source. Remote control equipment

shall be labeled according to the unit or system being controlled. Equipment labels shall be permanently affixed to the equipment with metal screws, permanent mounting devices or cement.

3. AC Power: The AC Power Panel Directory shall identify which equipment console, cabinet or enclosure that it serves. Each equipment console, cabinet or enclosure shall be labeled to identify which AC power panel provides power to it. These labels shall be permanently affixed to the equipment with metal screws, permanent mounting devices or cement.
4. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct, and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum every 3 meters 10 feet) identifying it as the System. Also, each enclosure shall be labeled according to this standard.

### **3.2 PROOF OF PERFORMANCE TESTS**

#### **A. Intermediate Testing**

1. After completion of the installation of a central control cabinet and equipment, nurse control master station, local and remote enunciation stations (code one [blue] systems only), the first ward (maximum of two wards), and prior to any further work, this portion of the System must be pretested, inspected, and certified. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed, NFPA, Life Safety, and JCAHCO guidelines are followed, and proper installation practices are followed. The intermediate test shall include a full operational test.
2. The inspection and test will be conducted by a factory-certified representative and witnessed by a Government Representative. The results of the inspection will be officially recorded by the Government Representative and maintained on file by the RE, until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 80% point of the system construction phase, at the direction of the RE.

#### **B. Pretesting:**

1. Upon completing installation of the System, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.

2. Pretesting Procedure:

- a. During the System pretest the Contractor shall verify (utilizing approved spectrum analyzer and test equipment) that the System is fully operational and meets all the System performance requirements of this standard.
  - b. The Contractor shall pretest and verify that all system functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, or polling noise are present. At a minimum, each of the following locations shall be fully pretested:
    - 1) Central Control Cabinets
    - 2) Nurse Control Stations
    - 3) Patient Stations
    - 4) Staff Stations
    - 5) Local and Remote Enunciation Panels (code one [blue] only)
    - 6) All Networked locations
    - 7) System interface locations (i.e. two way radio or PA)
    - 8) System trouble reporting
    - 9) System supervision
    - 10) UPS operation
3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.

C. Acceptance Test:

1. After the System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 30 days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total System meets all the requirements of this specification.

The notification of the acceptance test shall include the expected length (in time) of the test.

2. The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed System does comply with all requirements of this specification under operating conditions. The System shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the System that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8) hours to effect repairs, shall cause the entire System to be declared unacceptable. Retesting of the entire System shall be rescheduled at the convenience of the Government.

D. Acceptance Test Procedure:

1. Physical and Mechanical Inspection:

- a. The Government Representative will tour all major areas where the System is and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
- b. The System diagrams, record drawings, equipment manuals, Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.
- c. Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.

2. Operational Test:

- a. After the Physical and Mechanical Inspection, the central terminating and nurse call master control equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter may be utilized to accomplish this requirement.
- b. Following the central equipment test, a pillow speaker (or on board speaker) shall be connected to the central terminating and nurse call master control equipment's output tap to ensure there

are no signal distortions such as intermodulation, data noise, popping sounds, erratic system functions, on any function.

- c. The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last intersectional, room, and bed dome light in each leg to verify that the nurse call distribution system meets all system performance standards.
- d. Each MATV outlet that is controlled by a nurse call pillow speaker shall be functionally tested at the same time utilizing the Contractor's approved hospital grade TV receiver and TV remote control cable.
- e. The RED system and volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the RED system.
- f. Additionally, each installed emergency, patient, staff, duty, panic station, intersectional, room, and bed dome light, power supply, code one, and remote annunciator panels shall be checked insuring they meet the requirements of this specification.
- g. Once these tests have been completed, each installed sub-system function shall be tested as a unified, functioning and fully operating system. The typical functions are: nurse follower, three levels of emergency signaling (i.e. flashing red emergency, flashing white patient emergency, flashing white or combination lights for staff emergency, separate flashing code blue), minimum of ten minutes of UPS operation, memory saving, minimum of ten station audio paging, canceling emergency calls at each originating station only, and storage and prioritizing of calls.
- h. Individual Item Test: The Government Representative will select individual items of equipment for detailed proof of performance testing until 100% of the System has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.

3. Test Conclusion:

- a. At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the RE. Any retesting to

comply with these specifications will be done at the Contractor's expense.

- b. If the System is declared unacceptable without conditions, all rescheduled testing expenses will be born by the Contractor.

### **3.3 TRAINING**

- A. Furnish the services of a factory-trained engineer or technician for four eight-hour periods to instruct the Facility's maintenance personnel. Instruction shall include corrective and preventive maintenance of the nurse call equipment. Training shall be accomplished before the VA can accept the System. Additionally, training will be scheduled at the convenience of the Facility's, Chief Engineering Service.
- B. Furnish the services of a representative of the nurse call and code one OEM, familiar with the functions and operation of the equipment, for two eight-hour periods to train nursing personnel. Instructions shall be provided for staff personnel in each ward where new nurse call and code one (blue) equipment is provided under this contract. When multiple wards are involved, classes will be grouped. Periods of training shall be coordinated with the Chief of Nursing Service for the Facility to ensure all nursing shifts receive the required training. Each session shall include instructions utilizing a factory prepared and RE approved vertical - horizontal system (VHS) format video tape presentation and "hands-on" operation of the nurse call and code one (blue) equipment on a hospital ward. The tape presentation shall be sufficient in detail to stand-alone as a training aid for initial utilization and familiarization of the System. Additionally, the Contractor shall provide two (2) copies of the video presentation to the Chief of Nursing Service.

### **3.4 GUARANTEE PERIOD OF SERVICE**

- A. Contractor's Responsibility:
  - 1. The Contractor shall guarantee that all provided material and equipment will be free from defects, workmanship and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken possession of the building), that certifies each item of equipment installed conforms to OEM published specifications.



2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.
  3. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
  4. Additionally, the Contractor shall accomplish the following minimum requirements during the one year guaranty period.
- B. Response Time During the One Year Guaranty Period:
1. The RE or Facility Contracting Officer is the Contractor's reporting and contact official for nurse call system trouble calls, during the guaranty period.
  2. A standard work week is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.
  3. The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
    - a. A routine trouble call within one working day of its report. A routine trouble is considered a trouble which causes a pillow speaker or cordset, master nurse control station, patient station, emergency station, or dome light to be inoperable.
    - b. An emergency trouble call within four hours of its report. An emergency trouble is considered a trouble which causes a sub-system (ward), distribution point, terminal cabinet, or code one system to be inoperable at anytime.
  4. If a nurse call and/or code one (blue) component failure cannot be corrected within four hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate nurse call equipment. The alternate equipment/system shall be operational within a maximum of four hours after the four hour trouble shooting time and restore the effected location operation to meet the System performance standards. If any sub-system or major system trouble cannot be corrected within one working day, the Contractor shall furnish and install compatible substitute equipment

returning the System or sub-system to full operational capability, as described herein, until repairs are complete.

C. Required On-Site Visits During the One Year Guaranty Period

1. The Contractor shall visit, on-site, for a minimum of eight hours, once every 12 weeks, during the guaranty period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this document.
2. The Contractor shall arrange all Facility visits with the RE or Facility Contracting Officer prior to performing the required maintenance visits.
3. Preventive maintenance shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals during non-busy time agreed to by the RE or Facility Contracting Officer and Contractor.
4. The preventive maintenance schedule, functions and reports shall be provided to and approved by the RE or Facility Contracting Officer.
5. The Contractor shall provide the RE or Facility Contracting Officer a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:
  - a. The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to RE or Facility Contracting Officer by the fifth working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
  - b. The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the

situation and specific recommendations to avoid such conditions in the future.

6. The RE or Facility Contracting Officer shall convey to the Facility Engineering Officer, two (2) copies of actual reports for evaluation.

a. The RE or Facility Contracting Officer shall ensure a copy of these reports is entered into the System's official acquisition documents.

b. The Facility Chief Engineer shall ensure a copy of these reports is entered into the System's official technical record documents.

D. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, contractor, or owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The RE or Facility Contracting Officer will investigate all reported incidents and render findings concerning any Contractor's responsibility.

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