DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS

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G-101	COVER SHEET
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GENERAL REQUIREMENTS

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SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 GENERAL INTENTION

A. Contractor shall completely prepare site for SITE DEVELOPEMENT operations, building operations, including demolition and removal of existing structures, and furnish supervision, labor, materials, equipment, and transportation and perform work as required for project #659-12-239 HOSPICE CLC IMPROVEMENT.

B. Visits to the site by Bidders may be made only by appointment and will be conducted only on the designed day as directed by Government.

C. Before placement and installation of work subject to tests by testing laboratory retained by 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.

E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.

F. Prior to commencing work, general contractor shall provide proof that a OSHA certified “competent person” (CP) (29 CFR 1926.20(b)(2) will maintain a presence at the work site whenever the general or subcontractors are present.

E. Training:

1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA COR with input from the ICRA team. On site superintendent shall have the 30-hour OSHA certified Construction safety course.

2. Submit training records of all such employees for approval before the start of work. No contractor or subcontractor employee will be permitted to work until the required documents have been submitted and approved.

1.2 STATEMENT OF BID ITEM(S)

BID ITEM I (Base): The work includes, but not limited to installation of ornamental fence to match the height of existing chain link fence. Additional chain link fence shall be installed to connect into the new ornamental fence to be installed. At balcony locations at B43 new railing to be installed as per construction drawings. Contractor is to supply and install three indoor Pelco Spectra Mini-dome PTZ Cameras or equivalent to match existing system. Contractor to supply and install two outdoor Pelco spectra IV SL PTZ cameras or equivalent to match existing systems. All cameras shall be link to Bldg 12 as per construction drawings and contract documents. Contractor will install a Dog Kennel Door through existing wall located at the North West section of B43. Contractor shall build a wood dock as noted in construction drawing with electrical and plumbing works included. All necessary site investigation that is required must be performed in order finished wood piling operations. All conditions to be verify as existing and a Work Plan shall be submitted for government approval prior to any construction work taken place. The Work Plan shall include equipment, number of workers and identify Supervisor. The Work Plan shall also describe how work will be completed, hours per day, and at what time during the day work will be done. All trash and debris shall be re-move from area in accordance with contract documents and all construction work is to be performed in accordance to local building code, specifications, and contract/documents. All work, including final cleanup and completion of any punch list items, shall be performed within one hundred and twenty (120) calendar days of receipt of the Notice to Proceed. Work shall be performed in strict accordance with specifications and drawings.

BID ITEM II (DEDUCT ALTERNATE NO. 1) – Perform all work described in BID Item I, above except **DELETE** work associated with installation of 5 Cameras, video to be displayed and recorded at building 12, Police Dispatch, console on existing CM9760 Ports and DX8100 Series DVRs. All work, including final cleanup and completion of any punch list items, shall be performed within one hundred and ten (110) calendar days of receipt of the Notice to Proceed. Work shall be performed in strict accordance with specifications and drawings.

BID ITEM III (DEDUCT ALTERNATE NO. 2) – Perform all work described in BID Item II, above except **DELETE** work associated installation of additional chink link fencing, and ornamental fencing. All work, including final cleanup and completion of any punch list items, shall be performed within

ninety (90) calendar days of receipt of the Notice to Proceed. Work shall be performed in strict accordance with specifications and drawings.

BID ITEM IV (DEDUCT ALTERNATE NO. 3) – Perform all work described in BID Item III, above except **DELETE** work associated with installation Retaining wall. All work, including final cleanup and completion of any punch list items, shall be performed within one hundred and ten (90) calendar days of receipt of the Notice to Proceed. Work shall be performed in strict accordance with specifications and drawings

1.3 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. See Section 08 71 00, DOOR HARDWARE and coordinate.

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. This information shall be shared only with those with a specific need to accomplish the project.

4. Certain documents, sketches, videos or photographs and drawings may be marked “Law Enforcement Sensitive” or “Sensitive Unclassified”. Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.

5. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.

6. All paper waste or electronic media such as CD’s and diskettes shall be shredded and destroyed in a manner acceptable to the VA.

7. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of “sensitive information”.

8. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).

   a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.

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

E. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.

2. Separate permits shall be issued for General Contractor and its employees for parking in designated areas only.

1.4 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):

E84-2008.....Surface Burning Characteristics of Building Materials

2. National Fire Protection Association (NFPA):

10-2006.....Standard for Portable Fire Extinguishers

30-2007.....Flammable and Combustible Liquids Code

51B-2003.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2007.....National Electrical Code

241-2004.....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. 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.

C. 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).

D. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

E. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COR (CONTRACTING OFFICER’S TECHNICAL REPRESENTATIVE).

F. Egress Routes for Construction Workers: Maintain free and unobstructed egress.

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

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

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

J. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR.

K. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR and inform COR each day hot work is being performed.

L. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly, to COR.

M. 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.

N. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

O. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

1.5 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.

D. Working space and space available for storing materials shall be as determined by the COR.

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.

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. All such actions shall be coordinated with the Utility Company involved:

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

I. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at

maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.

J. When a storage or work area is turned over to Contractor, Contractor shall accept entire responsibility therefore.

1. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.

K. 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 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.

2. Contractor shall submit a request to interrupt any such services to COR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.

3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of 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.

L. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

M. 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.

N. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.6 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR in which alterations occur and areas which are

anticipated routes of access, and furnish a report to the Contracting Officer. This report shall noted on red line drawing:

1. Existence and conditions of items such as mechanical, electrical, and equipment, etc., required by drawings to be either reused or relocated, or both.

2. Shall note any discrepancies between drawings and existing conditions at site.

3. 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 the 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" and "CHANGES" and VAAR 852.236-88).

C. Re-Survey: Fifteen 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.

1.7 INFECTION PREVENTION MEASURES

A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.

B. Establish and maintain a dust control program as part of the contractor's infection preventive measures. Prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to COR.

1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center. They are to attend a viewing of the infection control measures video in building as directed by COR.

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. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Most of the work areas will <u>not</u> need negative pressure because they are Site Development works, but some occupied areas may need negative pressure construction areas as deemed necessary by the COR. 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, the 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.

a. 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.

b. 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.

c. 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.

1.8 DISPOSAL AND RETENTION

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

1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items 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.

1.9 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.

C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

D. "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; and
- Providing adequately maintained sanitary facilities.

1.10 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" and "DIFFERING SITE CONDITIONS".

1.11 PROFESSIONAL SURVEYING SERVICES

A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

1.12 LAYOUT OF WORK

A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings or located by professional land surveyor, 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.

B. Establish and plainly mark roads, parking lots, and are to be verify with lines and elevations shown on contract drawings.

C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs:

   1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the COR before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.

D. During progress of work, and particularly as work progresses, Contractor shall have line grades and plumbness of all major form work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the COR before any major items of concrete and Asphalt work are placed. In addition, Contractor shall also furnish to the COR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.

   1. Lines and elevations of sewers and of all outside distribution systems.

   2. Lines and elevations of roads, streets and parking lots.

E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing

bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to COR.

E'. Upon completion of the work, the Contractor shall furnish the COR, reproducible drawings at the scale of the contract drawings, showing the finished grade on the grid developed for constructing the work, including burial monuments and fifty foot stationing along new road centerlines. These drawings shall bear the seal of the registered land surveyor or registered civil engineer.

F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

1.13 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.

1.14 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.

1.15 TEMPORARY TOILETS

A. Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by COR, provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

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.

1.16 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. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and

damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:

1. Obtain heat by connecting to Medical Center heating distribution system.

   a. Steam is available at no cost to Contractor.

E. Electricity (for Construction and Testing): Furnish all temporary electric services.

1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.

F. Water (for Construction and Testing): Furnish temporary water service.

1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.

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

G. Steam: Furnish steam system for testing required in various sections of specifications.

1. Obtain steam for testing by connecting to the Medical Center steam distribution system. Steam is available at no cost to the Contractor.

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

H. Fuel: Natural and LP gas and burner fuel oil required for boiler cleaning, normal initial boiler-burner setup and adjusting, and for performing the specified boiler tests will be furnished by the Government. Fuel required for prolonged boiler-burner setup, adjustments, or modifications due to improper design or operation of

boiler, burner, or control devices shall be furnished by the Contractor at Contractor's expense.

1.17 THREE PHASE CONSTRUCTION:

A. PREPARATORY PHASE

Notify the COR at least 72 hours in advance of each preparatory phase meeting. The meeting will be conducted by the QC Specialists and/or the Project Superintendent, and the foreman responsible for the work. COR can attend only to ensure contractor has submitted all submittals and approved is following specifications and contract/documents.

1. Review each paragraph of the applicable specification sections.
2. Review the Contract drawings.
3. Verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders, in order to minimize waste due to excessive materials.
4. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required.
5. Review the testing plan and ensure that provisions have been made to provide the required QC testing.
6. Examine the work area to ensure that the required preliminary work has been completed.
7. Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
8. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data.
9. Discuss specific controls used and construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW.
10. Review the OSHA regulations and develop an Activity Hazard Analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted.

B. INITIAL PHASE

Notify the COR at least 24 hours in advance of each initial phase. When construction crews are ready to start work, conduct the initial phase with

the QC Specialists and/or the Project Superintendent, and the foreman responsible for that work. Observe the initial segment of the work to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily Report. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Daily Reports shall be prepare and submitted to COR for Quality Assurance documentations. The following issues shall be addressed:

1. Establish the quality of workmanship required.
2. Resolve conflicts.
3. Ensure that testing is performed by the approved laboratory.
4. Check work procedures for compliance with the safety and health requirements are met working in a hospital environment.

C. Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each work and documents in the daily Reports:

1. Ensure the work is in compliance with Contract requirements.
2. Maintain the quality of workmanship required.
3. Ensure that testing is performed by the approved laboratory.
4. Ensure that rework items are being corrected.
5. Assure manufacturers representatives have performed necessary inspections if required and perform safety inspections.

1.18 TESTS

A. 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.

B. 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.

1.19 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. The commercial

photographer or the subcontractor used for this work shall meet the following qualifications:

1. Demonstrable minimum experience of three (3) years in operation providing documentation and advanced indexing/navigation systems including a representative portfolio of construction projects of similar type, size, duration and complexity as the Project.

2. Demonstrable ability to service projects throughout North America, which shall be demonstrated by a representative portfolio of active projects of similar type, size, duration and complexity as the Project.

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. Documentation shall combine indexing and navigation system with inspection-grade digital photography designed to capture actual conditions throughout construction and at critical milestones. Documentation shall be accessible on-line through use of an internet connection. Documentation shall allow for secure multiple-user access, simultaneously, on-line.

4. Before construction, the building pad, adjacent streets, roadways, parkways, driveways, curbs, sidewalks, landscaping, adjacent utilities and adjacent structures surrounding the building pad and site shall be documented. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings. If site work or pad preparation is extensive, this documentation may be required immediately before construction and at several pre-determined intervals before building work commences.

5. Construction progress for all trades shall be tracked at pre-determined intervals, but not less than once every thirty (30) calendar days (“Progressions”). Progression documentation shall track both the exterior and interior construction of the building. Exterior Progressions shall track 360 degrees around the site and each building. Interior Progressions shall track interior improvements beginning when stud work commences and continuing until Project completion.

6. 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.

7. 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.

8. As-built conditions of exterior skin and elevations shall be documented with an increased concentration of digital photographs as directed by the COR in order to capture pre-determined focal points, such as waterproofing, window flashing, radiused steel work, architectural or Exterior Insulation and Finish Systems (EIFS) detailing. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive elevations or elevation details.

9. As-built finished conditions of the interior of each building including floors, ceilings and walls shall be documented at certificate of occupancy or equivalent, or just prior to occupancy, or both, as directed by the COR. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.

10. Miscellaneous events that occur during any Contractor site visit, or events captured by the Department of Veterans Affairs independently, shall be dated, labeled and inserted into a Section in the navigation structure entitled “Slideshows,” allowing this information to be stored in the same “place” as the formal scope.

11. Customizable project-specific digital photographic documentation of other details or milestones. Indexing and navigation accomplished through interactive architectural plans.

12. Monthly (29 max) exterior progressions (360 degrees around the project) and slideshows (all elevations and building envelope). The slideshows allow for the inclusion of Department of Veterans Affairs pictures, aerial photographs, and timely images which do not fit into any regular monthly photopath.

13. Weekly (21 Max) Site Progressions - Photographic documentation capturing the project at different stages of construction. These progressions shall capture underground utilities, excavation, grading, backfill, landscaping and road construction throughout the duration of the project.

14. Regular (8 max) interior progressions of all walls of the entire project to begin at time of substantial framed or as directed by the COR through to completion.

15. Detailed Exact-Built of all Slabs for all project slab pours just prior to placing concrete or as directed by the COR.

16. Detailed Interior exact built overlapping photos of the entire building to include documentation of all mechanical, electrical and plumbing systems in every wall and ceiling, to be conducted after rough-ins are complete, just prior to insulation and or drywall, or as directed by COR.

17. Finished detailed Interior exact built overlapping photos of all walls, ceilings, and floors to be scheduled by COR prior to occupancy.

18. In event a greater or lesser number of images than specified above are required by the COR, adjustment in contract price will be made in accordance with clause entitled "CHANGES” VAAR 852.236-88).

C. Images shall be taken by a commercial photographer and must show distinctly, at as large a scale as possible, all parts of work embraced in the picture.

D. Coordination of photo shoots is accomplished through COR. Contractor shall also attend construction team meetings as necessary. Contractor's operations team shall provide regular updates regarding the status of the documentation, including photo shoots concluded, the availability of new Progressions or Exact-Builts viewable on-line and anticipated future shoot dates.

E. Contractor shall provide all on-line domain/web hosting, security measures, and redundant server back-up of the documentation.

F. Contractor shall provide technical support related to using the system or service.

G. 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.

1.20 FINAL ELEVATION DIGITAL IMAGES

A. A minimum of four (4) images of each elevation shall be taken with a minimum 6 MP camera, by a professional photographer with different settings to allow the COR to select the image to be printed. All images are provided to the RE on a CD.

B. Photographs shall be taken upon completion, including landscaping. They shall be taken on a clear sunny day to obtain sufficient detail to show depth and to provide clear, sharp pictures. Pictures shall be 400 mm x 500 mm (16 by 20 inches), printed on regular weight paper, matte finish archival grade photographic paper and produced by a RA4 process from the digital image with a minimum 300 PPI. Identifying data shall be carried on label affixed to back of photograph without damage to photograph and shall be similar to that provided for final construction photographs.

1.21 MINIMUM ENERY CODE REQUIREMENTS FOR FACILITIES CONSTRUCTION VISN

Minimum Energy Code Requirements for Facilities Constructed within VISN 6
Source: ASHRAE Standard 90.1 2010

Insulation Values							
Station	*Climate Zone*	*Roof Insulation*	*Wall Insulation*	*Floor Insulation*	*Door Max overall U*	*Windows*	
						Max U	*Max SHGC*
Beckley	5A	For All: R-20 ci; Metal R-13 + R-13, Attic R38	R-13, 7.5ci; Metal R-19; Mass 9.5 ci, except 11.4 ci Beckley	R-30, Slab R-15 for 24"	0.7	0.45	0.4
Salisbury & Fayetteville	3A					0.6	0.25
All others	4A					0.5	0.4

Notes:
1. ci continuous insulation minimum (overlapping the studs).
2. Door overall U-Value includes any glass.
3. Any glazing within an exterior door shall have a minimum U value = 0.8, except for Salisbury & Fayetteville = 0.9.
4. Provide Shading for all E, W & S window if possible, overhangs or other permanent shading.

Lighting W/SF	
Office	1.11
Wtg/Lobby	0.90
Rest Rm	0.98
Corridor	0.66
Multi Purpose	1.23
Conf. Rm	1.23
Operating Rm	1.89
Emergency	2.26
Patient Rm	0.62
Recovery	1.15
Nurse Station	0.87
Exam Rm	1.66

Lighting Notes:
1. Provide combined infra-red/motion occupancy sensors (set for 30 min).
2. Provide Bldg Auto control to turn off all nonsafety lighting.
3. Provide daylighting control for spaces with windows or skylights.
4. VA Required FootCandle lighting levels shall be maintained within the lighting densities listed. See Chapter 6 2008 Electrical Design Guide.
5. Provide Exterior Lighting Densities as required in ASHRAE Standard 90.1-2010. and utilize LED exterior fixtures. Generally Parking Areas are 0.1W/SF
6. Consider LED Interior Fixtures, especially for corridors.

Receptacles (15 & 20 Amp): 50% Shall have Automatic Control, unless critical

HVAC (Heat Pump)				VRF System or GSPH preferred HVAC System s
Size	*Min Clg*	*Min Htg*	*Test*	
< 5 Tons	13 SEER	7.7 HSPF	ARI 210/240	Min SEER = 22
5 to 11 Tons	11 EER	3.3 COP	ARI 340/360	Min COP = 4.5
> 11 Tons	10.6 EER	3.2 COP	ARI 340/360	

Notes: 1. Any HVAC > 4.5 tons shall be provided with economizer control.

2. In order to meet the 20% "better than" for renovation & 30% "better than" for new work, HVAC Min SEER & EER shall be increased to 18 when equipment is available.

Domestic Water Heater <= 12KW
Min EF = 0.97 - (0.00132)(Volume) Test: DOE 10 CFR Part 430
Min Tank Insulation: R-12.5

DWH can be instantaneous (steam conversion), or instantaneous under sink as the application allows. If steam is to be in the bldg, then use steam instantaneous.

Notes: 1. For bldgs not occupied 24/7, provide DHW pump controls to start & stop pump according to occupancy schedule.

2. For all new bldgs & additions, solar thermal DHW shall be Life Cycle Cost evaluated for installation. Solar Thermal Evaluation shall be a part of the project file and installed if life cycle cost effective.

6

Water Requirements

Plumbing Fixtures:

EPA Water Sense

Fixture	Existing	New	How
Toilet	1.6 - 6 gpf	1 - 1.6 gpf	Location
Urinal	1 - 4 gpf	0 - 1pt/f	40 to 70k Gal
Faucet	2 - 5 gpm	1.5 gpm	25 Min/Dy
Shower Head	2 - 3 gpm	1.5 gpm	15 Min/Prsn/Dy

1. Leases: there are some exemptions.
2. Construction: Handout and code explanation, handout "Notice to Employees"

1.22 HISTORIC PRESERVATION

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

1.23 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 Resident Engineer 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 Resident Engineer and shall be considered concluded only when the Resident Engineer is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

Q. Contractor to return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that

may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

- - - E N D - - -

SECTION 01061
OSHA REQUIREMENTS - SAFETY AND HEALTH REGULATIONS
INFECTION CONTROL GUIDELINES
VAMC Salisbury North Carolina

PART 1 - OSHA REQUIREMENTS

1.1 GENERAL

A. Contractors are required to comply with the Occupational Safety and Health Act of 1970. This will include the safety and health standard found in CFR 1910 and 1926. Copies of those standards can be acquired from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20420

B. Training:
1. Beginning January 1, 2005, all employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team.
2. Submit training records of all such employees for approval before the start of work.

C. In addition, Contractor will be required to comply with other applicable Medical Center policies and safety regulations. These policies and regulations will be presented to the Contractor at the pre-construction meeting. Each of the Contractor's employees will be required to read the statement of policies and regulations and sign an acknowledgment that such policies and regulations are understood. Signed acknowledgment will be returned to the Project Superintendent.

D. Contractors involved with the removal, alteration, or disturbance of asbestos type insulation or materials will be required to comply strictly with the regulations found in CFR 1910.1001 and the appropriate EPA regulations regarding disposal of asbestos. Assistance in identifying asbestos can be requested from the Medical Center's Industrial Hygienist and the Project Engineer.

E. Contractors entering locations of asbestos contamination (i.e. pipe basements) shall be responsible for providing respiratory protection as required to their employees and ensuring respirators are worn in accordance with OSHA (CFR 1910.1001 (g)). Asbestos contaminated areas shall be defined on project drawings. The minimum equipment requirements will be a half-mask air-purifying respirator equipped with high efficiency filters and disposable Tyvek coveralls.

F. Contractor, along with other submittals, and at least two weeks prior to brining any materials on-site, must submit a complete list of chemicals the Contractor will use and MSDS for all hazardous materials as defined in OSHA 1910.1200 (d) Hazard Determination. Contracting Officer shall have final approval of all materials brought on site.

G. The Medical Center Safety and Occupational Health Specialist will closely monitor all safety aspects of the project. Severe or constant violations may result in an immediate work stoppage or request for a Compliance Officer from the Occupational Safety and Health Administration.

H. During all phases of demolition, construction and alterations, Contractors are required to understand and strictly follow NFPA 241 Standard for Safeguarding Construction,

Alteration and Demolition Operations. The Medical Center's Safety and Occupational Health Specialist and Industrial Hygienist will closely monitor the work area for compliance. Appropriate action will be taken for non-compliance.

PART 2 - SPECIFIC VA MEDICAL CENTER FIRE & SAFETY POLICIES, PROCEDURES & REGULATIONS

2.1 INTRODUCTION

A. The safety and fire protection of patients, employees, members of the public and government is one of continuous concern to this Medical Center.

B. Contractors, their supervisors and employees are required to comply with Medical Center policies to ensure the occupational safety and health of all. Failure to comply may result in work stoppage.

C. While working at this Medical Center, Contractors are responsible for the occupational safety and health of their employees. Contractors are required to comply with the applicable OSHA standards found in 29 CFR 1910 for general industry and 29 CFR 1926 for construction. Failure to comply with these standards may result in work stoppage and a request to the Area Director of OSHA for a Compliance Officer to inspect your work site.

D. Contractors are to comply with the requirements found in the National Fire Protection Association (NFPA) #241, Building Construction and Demolition Operations and NFPA #51B, Fire Prevention in Use of Cutting and Welding Processes.

E. Questions regarding occupational safety and health issues can be addressed to the Medical Center Safety and Occupational Health Specialist or the Medical Center Industrial Hygienist.

F. Smoking is not permitted in any interior areas of the Medical Center, including all interior stairwells, tunnels, construction and/or service/maintenance sites. (Note: This includes interior posted patient smoking areas). Compliance with this policy by your direct and subcontracted labor force is required.

2.2 HAZARD COMMUNICATION

A. Contractors shall comply with OSHA Standard 29 CFR 1926.59 Hazard Communication.
B. Contractors shall submit to the VA Safety and Occupational Health Specialist, copies of Material Safety Data Sheets covering all hazardous materials to which the Contractor and VA employees are exposed.

C. Contractors shall inform VA Safety and Occupational Health Specialist personnel of the hazards to which VA personnel and patients may be exposed.
D. Contractors shall have a written Hazard Communication Program, which details how the Contractor will comply with 29 CFR 1926.59.

2.3 FIRES

All fires must be reported. In the event of a fire in your work area, use the nearest pull box station and also notify Medical Center staff in the immediate area. Emergency notification can also be accomplished by dialing ext. 3333.

This is the emergency phone only. Be sure to give the exact location from where you are calling. If a Contractor has experienced a fire and it was rapidly extinguished, you still must notify the Medical Center Safety Staff immediately (ext. 3333) such that an investigation of the fire can be accomplished. Delay in reporting a fire is unacceptable.

2.4 FIRE ALARMS, SMOKE DETECTION AND SPRINKLER SYSTEM

If the nature of your work requires the deactivation of the fire alarm, smoke detection or sprinkler system, you must notify the Resident Engineer and Medical Center Safety Staff. Notification must be made well in advance such that ample time can be allowed to deactivate the system and provide alternative measures for fire protection. Under no circumstance is a Contractor allowed to deactivate any of the fire protection systems in this Medical Center.

2.5 SMOKE DETECTORS

False alarms will not be tolerated. You are required to be familiar with the location of the smoke detectors in your work area. When performing cutting, burning or welding or any other operations that may cause smoke or dust, you must take steps to temporarily cover smoke detectors in order to prevent false alarms and maintain cleanliness of the smoke detectors. Failure to take the appropriate action will result in the Contracting Officer assessing actual costs for government response for each false alarm that is preventable. Prior to covering the smoke detectors, the Contractor will notify the VAMC Safety Staff, who will also be notified when the covers are removed at a minimum at the end of each work day.

2.6 HOT WORK PERMIT

A. Hot work is defined as operations including, but not limited to, cutting, welding, thermal welding, brazing, soldering, grinding, thermal spraying, thawing pipes, or any similar situation. If such work is required, the Contractor must notify the Resident Engineer no less than one day in advance of such work. The VAMC Safety Staff will inspect the work area and issue a Hot Work Permit authorizing the performance of such work.

B. All hot work will be performed in compliance with NFPA 241, Safeguarding Construction, Alternation, and Demolition Operations, and NFPA 51B, Fire Prevention in Use of Cutting and Welding Processes, and applicable OSHA standard. A hot work permit will only be issued to individuals familiar with these regulations.

C. A hot work permit will only be issued when the following conditions are met:

1. Combustible materials are located a minimum of 35 feet from the work site, or protected by flameproof covers or shielded with metal or fire-resistant guards or curtains.

2. Openings or cracks in walls, floors, or ducts within 35 feet of the site are covered to prevent the passage of sparks to adjacent areas.

3. Where cutting or welding is done near walls, partitions, ceiling, or roof of combustible construction, fire resistant guards or shields are provided to prevent ignition.

4. Cutting or welding on pipes or other metal in contact with combustible walls, ceilings or roofs is not undertaken if the work is close enough to cause ignition by conduction.

5. Fully charged and operable fire extinguishers, appropriate for the type of possible fire, are available at the work area.

6. When cutting or welding is done in close proximity to a sprinkler head, a wet rag is laid over the head during operation.

7. Assure that nearby personnel are protected against heat, sparks, cut off, etc.

8. Assure that a fire watch is at the site. Make a final check-up 30 minutes after completion of operations to detect and extinguish any smoldering fires.

D. A fire watch shall be provided by the Contractor whenever cutting, welding, or performing other hot work. Fire watcher(s) shall:

1. Have fire-extinguishing equipment readily available and be trained in its use.

2. Be familiar with facilities and procedures for sounding an alarm in the event of fire.

3. Watch for fires in all exposed areas, sound the fire alarm immediately, and try to extinguish only within the capability of the portable extinguishing equipment available. In all cases if a fire is detected the alarm shall be activated even if the fire is extinguished.

4. Maintain the watch for at least a half-hour after completion of operations to detect and extinguish smoldering fires.

E. A Hot Work Permit will be issued only for the period necessary to perform such work. In the event the time necessary will exceed one day, a Hot Work Permit may be issued for the period needed; however, the VAMC Safety Staff will inspect the area daily. Hot work permit will apply only to the location identified on the permit. If additional areas involve hot work, then additional permits must be requested.

F. Contractors will not be allowed to perform hot work processes without the appropriate permit.

G. Any work involving the Medical Center's fire protection system will require notification of the VA Safety Staff and Resident Engineer. Under no circumstances will the Contractor or employee attempt to alter or tamper with the existing fire protection system.

H. Upon completion of all hot work, the VA Safety Staff will be notified to perform an inspection of the area. It is recommended that the inspection take place approximately 30 minutes after the hot work is completed to confirm that sparks or drops of hot metal are not present.

2.7 TEMPORARY ENCLOSURES

Only non-combustible materials will be used to construct temporary enclosures or barriers at this Medical Center. Plastic materials and fabrics used to construct dust

barriers must conform to NFPA #701, Standard Methods of Fire Tests for Flame-Resistant Textiles and Films.

2.8 FLAMMABLE LIQUIDS

All flammable liquids will be kept in approved safety containers. Only the amount necessary for your immediate work will be allowed in the building. Flammable liquids must be removed from the building at the end of each day.

2.9 COMPRESSED GAS CYLINDERS

Compressed gas shall be secured in an upright position at all times. A suitable cylinder cart will be used to transport compressed gas cylinders. Only those compressed gas cylinders necessary for immediate work will be allowed in occupied buildings. All other will be stored outside of buildings in a designated area. Contractor will comply with applicable standards compressed gas cylinders found in 29 CFR 1910 and 1926 (OSHA).

2.10 INTERNAL COMBUSTION ENGINE-POWERED EQUIPMENT

Equipment powered by an internal combustion engine such as saws, compressors, generators and etc. will not be used in an occupied building. Special consideration may be given for unoccupied buildings only if the OSHA and NFPA requirements have been met.

2.11 POWDER ACTIVATED TOOLS

Powder activated tools will be kept in a secured manner at all times. When not in use, the tools will be locked up. When in use, the operator will have the tool under his immediate control.

2.12 TOOLS

A. Under no circumstances is equipment, tools and other items of work to be left unattended for any reason. All tools, equipment and items of work must be under the immediate control of your employee.

B. If for some reason a work area must be left unattended, then it will be required that tools and other equipment be placed in an appropriate box or container and locked. All toolboxes, containers or any other device used for the storage of tool and equipment, will be provided with a latch and padlock. All tool boxes, containers or any other device used for the storage of tools and equipment, will be locked at all times except for putting in and removing tools.

C. All doors to work areas will be closed and locked when room are left unattended. Failure to comply with this directive will be considered a violation of VA Regulations 1.218 (b), Failure to comply with signs of a directive and restrictive nature posted for safety purposes, subject to a $50.00 fine. Subsequent similar violations may result in both imposition of such a fine as well as the Contracting Officer taking action under the Contract's Accident Prevention Clause (FAR 52.236-13) to suspend all contract work until violations such may be satisfactorily resolved or under FAR 52.236-5 Material and Workmanship Clause to remove from the work site any personnel deemed by the Contracting Officer to be careless to the point of jeopardizing the welfare of Facility patients or staff.

D. You must report to the VA Police Department, Ext. 3333, any tools or equipment that are missing.

E. Tools and equipment found unattended will be confiscated and removed from the work area.

2.13 LADDERS

It is required that ladders not be left unattended in an upright position. Ladders must be attended at all times or taken down and chained securely to a stationary object.

2.14 SCAFFOLDS

All scaffolds will be attended at all times. When not in use, an effective barricade (fence) will be erected around the scaffold to prevent use by unauthorized personnel.

2.15 EXCAVATIONS

All excavations left unattended will be provided with a barricade suitable to prevent entry by unauthorized persons.

2.16 STORAGE

You must make prior arrangements with the Project Inspector for the storage of building materials. Storage will not be allowed to accumulate in the Medical Center buildings.

2.17 TRASH AND DEBRIS, CLEANING

You must remove all trash and debris from the work area and perform at least general cleaning on a daily basis. Trash and debris will not be allowed to accumulate inside or outside of the buildings. You are responsible for making arrangements for removal of trash from the Medical Center facility.

2.18 PROTECTION OF FLOORS

It may be necessary at times to take steps to protect floors from dirt, debris, paint, etc. A tarp or other protective covering may be used. However, you must maintain a certain amount of floor space for the safe passage of pedestrian traffic. Common sense must be used in this matter.

2.19 SIGNS

Signs must be placed at the entrance to work areas warning people of your work. Signs must be suitable for the condition of the work. Small pieces of paper with printing or writing are not acceptable. The VAMC Safety Officer can be consulted in this matter.

2.20 ACCIDENTS AND INJURIES

Contractors must report all accidents and injuries involving your employees. The Contractor may use the VAMC for emergency care only.

2.21 CONFINED SPACE ENTRY

A. Contractor will be informed that the workplace contains permit required confined space and that permit space entry is allowed only through compliance with a permit space program meeting the requirements of 29 CFR 1910.146 and 1926.21 (b)(6).

B. Contractor will be apprised of the elements including the hazards identified and the Medical Center's (last employer) experience with the space that makes the space in question a permit space.

C. Contractor will be apprised of any precautions or procedures that the Medical Center has implemented for the protection of employees in or near permit space where Contractor personnel will be working.

D. Medical Center and Contractor will coordinate entry operations when both Medical Center personnel and Contractor personnel will be working in or near permit spaces as required by 29 CFR 1910.146 (d)(ii) and 1926.21 (b)(6).

E. Contractor will obtain any available information regarding permit space hazards and entry operation from the Medical Center.

F. At the conclusion of the entry operations the Medical Center and Contractor will discuss any hazards confronted or created in permit spaces.

G. The Contractor is responsible for complying with 29 CFR 1910.246 (d) through (g) and 1926.21 (b)(6). The Medical Center, upon request, will provide rescue and emergency services required by 29 CFR 1910.246 (k) and 1926.21 (b)(6).

2.22 CONTRACTOR PARKING

There will be no parking on the grass or Contractor vehicle parking at work sites. Contractors will deliver supplies, tools etc., drop them off at the work site, return their vehicles to the designated project parking area. The designated parking area is as noted on the project plans or in the specifications. Under no circumstances will the contractor park in designated patient parking areas.

2.23 SMOKE BARRIER PENETRATION PERMIT (See Attachment D)

Contractor shall obtain smoke barrier penetration permit from Medical Center Safety Office prior to penetration of any defined smoke barrier. Comply with Medical Center policies and requirements for this work.

2.24 CONTRACT HEALTH ASSESSMENT

Any contracted individual who will be working in patient care areas (or with persons who provide direct patient care), or working closely with other employees, or with patient care items, MUST provide documentation of the following:

- PPD Skin Test – results from the last three months will be accepted. If PPD is positive, the individual MUST provide documentation of the absence of active TB (Chest X-ray).
- Hepatitis B immunization, or declination – those contracted individuals who will have contact with blood, body fluids, or other potentially infectious materials MUST provide documentation of a Hepatitis B Vaccination series or declination.
- Documentation of Bloodborne Pathogen Training must be maintained.

It is the contractor's responsibility to provide documentation of all the above prior to starting work. Copies of the documentation are to be maintained with the project/contract files. The Contracting Officer and Resident Engineer should be notified of any changes in individual status with appropriate documentation. In the event of an exposure, it is required that the contractor (employer) has a plan that must be followed to protect the individual contract worker. Records must be maintained as required by CFR 1910.1030.

2.25 ASBESTOS WORK AND OTHER HAZARDOUS MATERIAL ABATEMENT

Contractor shall follow all contract requirements for work with asbestos and other hazardous materials abatement. Contractor is responsible for submitting all waste manifests to show proper disposal of materials prior to completion of project.

W. G. (BILL) HEFNER VA MEDICAL CENTER
SALISBURY, NORTH CAROLINA

MEDICAL CENTER MEMORANDUM 659-138-25 DECEMBER 30, 2010
CHANGE 1

PROJECT DEVELOPMENT AND IMPLEMENTATION

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1. PURPOSE: To establish medical center policy and procedure for the development of construction projects to ensure compliance with all applicable code and VA requirements and implementation that provides necessary aspects of the project scope in a cost effective manner.

2. POLICY:

a. It is the policy of the Salisbury VA Medical Center (SVAMC) to design projects that comply with VA Construction Standards, VA Barrier-Free Design Handbook, Life Safety Code, Uniform Plumbing Code, VA HVAC Design Criteria, Uniform Building Code, Local Building Codes, National Fire Protection Association (NFPA) Codes and medical center Infection Control Policy.

b. All designs for new construction will include accessibility to parking lots, including reserved parking. All SVAMC buildings will have at least one entrance/exit that is accessible to the handicapped. This includes, but is not limited to, handicap ramps, automatic doors or doors with appropriate hardware to render them accessible to the handicapped, Braille signage, tactile warning strips and handrails.

c. The SVAMC will also provide handicap accessibility to all public areas, amenities, and elevators.

3. RESPONSIBILITY:

a. Project Design (Development Phase):

(1) Requesting services will provide project scope input prior to and during the design phase, which will incorporate criteria and special requirements for equipment and procedures related to the design area. Upon completion of the design, the using service chief will sign the design drawing.

(2) Project design staff, including architect/engineering (A/E) firms, shall certify to the Chief, Facilities Management Service (FMS) that all applicable codes have been met by initialing the "Drawn By" and "Checked By" blocks on the project drawings. When a project is designed or developed for construction that impacts life safety or fire protection with greater than 50% of the work involving fire safety improvements or changes, the A/E for the design must have a Fire Protection Engineer or staff who is a qualified professional with knowledge of NFPA Fire Codes in accordance with VHA

Directive 2005-007, Fire Code Reviews Of Delegated Construction Projects, dated February 15, 2005. A/E firms shall also apply their seals.

(3) The project design staff will review the H-08-13 "Checklist for Barrier Free Design" and other design criteria to assure projects are designed to eliminate all deficiencies. Special attention shall be paid to new parking areas, building entrances, public amenities, and elevators. The project design staff and an Infection Control representative will perform an infection control assessment and complete associated checklists (see Attachment B) using the Infection Control Guidelines (see Attachment A).

(4) Chief, FMS shall be responsible for certifying that each project complies with the appropriate codes.

(5) Copies of the approved drawings and specifications are prepared for the CO, so that the construction phase may be accomplished.

b. Project Construction (Implementation Phase):

(1) After contract award the Contracting Officers Technical Representative (COTR) will participate in the pre-construction conference held with the CO, the contractor, Infection Control representative, Safety representative, Maintenance and Operations representative and a representative from the requesting service. In this meeting the COTR will provide the contractor with information regarding safety regulations, permit requirements for welding/open flame devices and confined space entry, policies on parking, identification badges, door keys, smoking, hazardous materials and waste management, fire safety and prevention and control of infection. Additionally the contractor will receive samples of a safety letter, cost breakdown, progress schedule graph, daily log, progress payment request form and payroll sheet, as well as a construction fire safety checklist and an infection control checklist (Attachment C).

(2) Prior to beginning construction activities, the COTR, along with an Infection Control representative, will complete an infection control risk assessment, and, where indicated by the assessment, an infection control construction and pre-occupancy checklist (Attachment A). These documents will be used throughout the construction phase to assure compliance with infection control requirements.

(3) Prior to beginning construction activities, the COTR and a Safety representative will complete a safety assessment, and, where indicated by the assessment, develop interim life safety measures to be used throughout the construction phase to assure compliance with the Life Safety Code. Interim Life Safety Measures are to be developed if at any time the effectiveness of the fire protection system is decreased.

(4) During the construction phase, the COTR will make regular site visits to assure compliance with the drawings and specifications and all safety and infection control

regulations and requirements. He/she will report any deficiencies to the CO for corrective actions. Additionally, he/she will advise the CO about the need for any contractual changes as the construction progresses and provide cost estimates as appropriate.

(5) During the construction phase, the COTR will review and process progress payment requests and contract change proposals from the contractor. He/she will maintain a contract file that includes all documentation relating to the contract, daily logs, construction photographs, etc. At the conclusion of the contract he/she will participate in the final inspection and process the final payment, final inspection report and final settlement report, along with a capitalization report to Resource Management Service.

4. REFERENCE:

TJC Comprehensive Accreditation Manual for Hospitals

5. RESCISSION: Medical Center Memorandum 138-25, dated August 8, 2007.

6. FOLLOW-UP RESPONSIBILITY: Chief, Facilities Management.

7. AUTOMATIC RESCISSION DATE: December 30, 2013 (Change 1)

8. ANNUAL REVIEW:

First Year Review: _____ _____
Responsible Official Date

Second Year Review: _____ _____
Responsible Official Date

/s/
PAUL M. RUSSO, MHSA, FACHE, RD
Director

Attachments

Attachment A

INFECTION CONTROL GUIDELINE
CONTRUCTION AND RENOVATION

OBJECTIVE: To prevent the acquisition of nosocomial infections in-patients and healthcare workers during medical center renovations or construction activities.

POLICY:

1. All renovation or construction projects will be reviewed with Infection Control during the planning phases.
2. Infection Control will participate in meetings and area walk-through inspections as necessary.
3. All construction workers, including subcontractors, and Facilities Management employees, must follow the infection control procedures as described in the guideline.
4. Appropriate pre-employment screening must be completed prior to starting work in clinical areas.

CONSTRUCTION PHASE

1. Medical Waste
   a. Hospital staff shall ensure the removal of any medical waste, including sharps containers, from areas to be renovated or constructed PRIOR to the start of the project.
   b. Infection Control shall be notified by Facilities Management staff immediately if unexpected medical waste is encountered.

2. Barrier Walls

Construction or renovation sites must be separated from patient-care areas and critical areas such as SPD and Pharmacy by barriers that keep the dirt and dust inside the worksite.

   a. The integrity of the barrier walls must assure a complete seal of the construction area from adjacent areas.
   b. Rigid construction or fire-rated plastic sheeting (4 or 6 mil thickness) are used, depending on the location of the project, adjacent uses, and duration of the project.
   c. Walls will be dustproof with airtight seals maintained at the full perimeter of the walls as well as all penetrations.

3. Environmental Control

   a. Negative air pressure will be maintained within the construction zone with no disruption of the air systems of the adjacent areas, depending on project location. A HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns (effective for pollen, mold spores, and dust particles) shall be

installed to insure continuous negative air pressures within the work area. There should be no recirculation of air, and ventilation filters will be changed as needed.

b. Demolition debris will be removed from the construction area in tightly fitted covered carts using specified traffic patterns daily.

c. Tacky or walk-off mats shall be utilized immediately outside the construction zone to remove dust and soil from shoes, cart wheels, etc. as personnel exit the area. The tacky mat must be large enough to cover the entire exit and is changed whenever necessary, usually at least twice per day.

d. Exterior window seals must minimize infiltration of outside excavation debris. Windows will remain closed at all times.

e. When using demolition chutes, chute openings must be sealed when not in use. The chute and damper should be sprayed with water, as necessary, to maintain dust control.

f. Control, collection and disposal must be provided for any drain liquid or sludge encountered when demolishing plumbing.

4. Traffic Control

a. Designated entry and exit procedures will be defined (in conjunction with any necessary Interim Life Safety Measures) for each construction project where applicable.

b. All egress pathways will be free of debris.

c. Unauthorized personnel will not be allowed to enter the construction zone.

d. Only designated elevators will be used for construction activities during scheduled times.

5. Cleaning

a. The construction zone and adjacent entry areas shall be maintained in a clean and sanitary manner by the contractors and will be swept and wet mopped daily or more frequently as needed to minimize dust generation.

b. Environmental Management Service may be responsible for the routine cleaning of adjacent areas and for the terminal cleaning of the construction zone prior to the opening of the newly renovated or constructed area. Specific responsibility will be defined in the construction contracts.

6. Personnel Requirements

a. Clothing shall be free of loose soil and debris upon exiting the construction zone.

b. Personal protective equipment, including face shield, gloves, and N95 respirators will be utilized as appropriate.

c. Personnel entering sterile/invasive procedure areas will be provided with a disposable jump suit, head covering and shoe coverings, which must be removed prior to exiting the work area.

1) Tools and equipment must be damp-wiped prior to entry and exit from sterile and invasive procedure areas.

2) Tools and equipment soiled with blood and body fluids will be cleaned with an approved germicide.

d. All contractors, subcontractors and Facilities Management employees shall receive infection control training as it relates to construction.

7. Environmental Monitoring

a. Infection Control, in conjunction with Facilities Management and Safety, will plan for environmental monitoring as appropriate for the project.

COMPLETION PHASE

1. After completion of construction, ventilation will meet specifications as mandated by regulatory bodies.
2. The area will be thoroughly cleaned and disinfected before being placed into service.
3. Water supply lines will be flushed before placing newly renovated or constructed areas in service. Infection Control shall be notified prior to the flushing.
4. Industrial Hygiene shall certify that water supply lines are safe for use.

COMPLIANCE MONITORING

1. Medical Center staff (Contracting Officer (COTR), Safety Representative and Infection Control) and the contractor will conduct compliance monitoring as necessary. The following parameters may be monitored:

a. Air handling
b. Integrity of barrier walls
c. Dress code
d. Environmental control
e. Traffic control
f. Personal protective equipment
g. Water supply

Attachment B

W.G. 'BILL' HEFNER VETERANS AFFAIRS MEDICAL CENTER
June 2004

RISK ASSESSMENT MATRIX: IC GUIDELINES FOR CONSTRUCTION			
CLASS	CONSTRUCTION ACTIVITY	RISK	PRECAUTIONS REQUIRED
CLASS I	Type A: Inspection and Non-Invasive Activities. Includes, but is not limited to: 1. Small scale removal of ceiling tiles for visual inspection or minor installation. 2. Painting (but not sanding). 3. Wallcovering, electrical trim work, minor plumbing, and activities that do not generate dust or require cutting of walls.	Low or Moderate Risk Patients Only High Risk Requires Class II Precautions	1. Execute work by methods to minimize raising dust from construction operations. 2. **Immediately replace a ceiling tile displaced for visual inspection**.
CLASS II	Type B: Small scale, short duration activities that create minimal dust. **Includes, but is not limited to:** **1. Access to chase spaces.** **2. Cutting of walls or ceiling where dust migration can be controlled.**	Low or Moderate Risk Patients Only High Risk Requires Class III Precautions	1. Notify staff in the immediate area. 2. Provide active means to prevent airborne dust from dispersing into air. 3. Water mist work surfaces while cutting. 4. Seal unused doors with duct tape. 5. Block off and seal air vents. 6. Place dust mat at entrance/exit of area. 7. Contain construction waste before transport in tightly covered containers. **8. Upon completion, wipe work surfaces with disinfectant, wet mop and/or vacuum and remove isolation of HVAC system.**
CLASS III	**Type C: Work that generates a moderate to high level of dust or requires demolition or removal of any fixed building components and assemblies or new construction.** Includes, but is not limited to: 1. Sanding of walls for painting or wall covering. 2. Removal of floor coverings, ceiling tiles, and casework. 3. New wall construction. 4. Uncontained duct, HVAC or electrical work above ceiling. 5. Major cabling activities. 6. Any other project where high levels of dust are generated.	**Moderate or High Risk Patients only** **Low Risk Requires Class II Precautions**	In addition to Class II Precautions above, 1. Obtain IC concurrence before construction begins. 2. Complete all critical barriers, i.e., sheetrock, plywood, plastic, to seal from non-work area or implement control cube method (cart with plastic covering/sealed connection to work site with vacuuming prior to exit) before construction begins. 3. Isolate HVAC system in area and maintain negative air pressure within work site. 4. Cover transport receptacles or carts. 5. Seal holes, pipes, conduits, and punctures. 6. Personnel required to ensure shoes are not tracking when leaving the work site. 7. Upon completion, do not remove barriers until inspected by Safety and IC and thoroughly cleaned by FMS. Remove barrier materials carefully to minimize spreading of dirt and debris.

PATIENT RISK GROUP		
Low Risk Group	Medium Risk Group	High Risk Group
Administrative Offices Lobbies Public Corridors Elevators Day Rooms Canteen Retail Store	**Outpatient, Urgent Care and Primary Care Clinics** Laboratory Radiology and Nuclear Medicine Physical Therapy Respiratory Therapy Pharmacy Food Services Interim Care and Medical Units	SPD Storage/Sterilization Intensive Care Units TB Negative Pressure isolation rooms Operating Room

CONSTRUCTION RISK REDUCTION PLAN	
Location of Construction: _____	Project Start Date:
Contractor Performing Work:	Estimated Duration:

√	CONSTRUCTION ACTIVITY	√	IC RISK GROUP
	Type A: Inspection, non-invasive, minor		Low Risk
X	Type B: Small scale, short duration, moderate levels.	X	Medium Risk
	Type C: Major activity generates moderate to high levels of dust.		High Risk

√	INFECTION CONTROL PRECAUTIONS		
	CLASS I	1. Execute work by methods to minimize raising dust from construction operations. 2. Immediately replace any ceiling tile displaced for visual inspection.	
X	**CLASS II**	1. Provides 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. Place dust mat at entrance and exit of work area. 6. Contain construction waste before transport in tightly covered containers. 7. Upon completion, wipe work surfaces with disinfectant, wet mop and/or vacuum and remove isolation of HVAC system.
	CLASS III	In addition to Class II Precautions above, 1. Obtain IC concurrence before construction begins. 2. Complete all critical barriers or implement control cube method before construction begins. 3. Control airflow: Isolate HVAC system in areas where work is being performed and maintain negative air pressure within work site. 4. Cover transport receptacles or carts.	5. Seal holes, pipes, conduits, and punctures appropriately 6. Personnel are required to ensure shoes are not tracking dust and soil when leaving the work site. 7. Upon completion, do not remove barriers until inspected by Safety and Infection Control and thoroughly cleaned by FMS. Remove barrier materials carefully to minimize spreading of dirt and debris.

INTERIM LIFE SAFETY MEASURES

√	CLASS	ACTIVITY	ILSM PRECAUTIONS
X	CLASS I	Minor: No breech of fire detection, alarm or fighting systems. No egress or access blockage.	None required beyond routine general safety precautions. Ensure egress. Ensure access for Emergency forces. Ensure operational Life Safety Systems. Prohibit smoking.
	CLASS II	Moderate: Short-term breech of fire detection, alarm or fighting systems < a single work shift. Blockage of egress or access but second means available.	In addition to Class I ILSMs, apply at-the-site measures. Notify staff in the immediate area. Control combustible loads. Repair/construction staff immediately available at the site. Compensate for compartmentalization deficiencies? Each single breech of fire barrier immediately replaced.
	CLASS III	Major: Multiple or continuous breech of fire detection, alarm or fighting systems. Blockage of egress or access. Work > a single shift.	In addition to Class I and II ILSMs, obtain Safety Manager concurrence before construction begins. Construct temporary smoke tight barriers of non-combustible materials. Provide additional fire fighting equipment. Designate alternative exit/access routes. Increase Hazard Surveillance. Provide additional education to applicable Medical Center Staff/Incident Response Team Conduct 2 fire drills per shift in local areas vs. all areas. Notify Emergency Forces.

Additional Requirements including air quality, noise, vibration, utility failure issues, ILSM, emergency procedures or other issues not addressed above: **CONTRACTOR WILL NEED TO ENSURE DEMOLTION DUST IS NOT BLOWN INTO BUILDINGS OR DUCT SYSTEMS.**

_____Exceptions/Additions to this permit. .

SIGNATURES:	Date:		Date:
Project Coordinator		Safety Manager	
Chief, FMS		Infection Control	

Infection Control Program
Construction Rounds Checklist

Project: _____

LOCATION	INFECTION CONTROL
1	Monitor barrier for integrity and airflow from clean to dirty (Construction)
2	Demonstrate compliance with traffic patterns, both construction worker and debris/worker movement.
3	Floors free of visible track dirt in clinical corridors and support areas.
4	Demonstrate compliance with cover clothing.
5	Demonstrate use of equipment to prevent airborne particle material from migrating to patient care areas to include: portable HEPA filters, HEPA filtered vacuums, self-closing construction doors, or appropriate use of exhaust fans or debris chutes. Negative air pressure in construction site when indicated.
6	Doors closed to construction site and appropriate signage in place.
7	Demonstrate appropriate debris transport: covered cart, dedicated elevator, designated route, etc.
8	All windows, doors, and debris chutes to the outside are closed and secured after hours.
9	Carpet or other track dirt compliance aids (tacky mats) are in place at the doors leading to the hospital/clinic/support space. Housekeeping notified for “as needed” cleaning.
10	Water leakage must be handled in an emergent fashion in occupied areas. Immediate control of large leaks may necessitate drying. (<72 Hrs.)
11	Areas cleaned at the end of the day. Trash emptied in break area.
12	Pest control - No visible signs of mice, insects, birds, or squirrels or other vermin.
13	Roof protection in place for projects on the roof.

COMMENTS/CORRECTIVE ACTION:
_____
_____
_____
_____
_____
_____
_____

Signature: _____ **Date:** _____

Attachment C

INFECTION CONTROL ORIENTATION

CONSTRUCTION SERVICE WORKERS

The goal of the Infection Control Program is to identify and reduce the risks of acquiring and transmitting infections among patients, employees, physicians and other licensed independent practitioners, contract service workers, volunteers, students and visitors. Pre-employment health screening may be required prior to beginning work in patient care or other designated high-risk areas.

During construction, renovation and minor improvement projects, hidden infectious disease hazards may be released into the air, carried on dust particles or on clothing - for example, fungal organisms such as *Aspergillus*. *Aspergillus* species may be found in decaying leaves and compost, plaster and drywall, and settled dust. These organisms usually do not cause problems in healthy people, but may be a risk for already sick patients. *Aspergillus* and other fungal organisms can cause illness and even death in premature babies, transplant patients, cancer treatment patients, and patients with lung problems or poor immunity. Therefore, it is critical that you do your part to keep our patients, employees, and visitors as safe and healthy as possible. We, in turn, will make conditions as safe as possible for you.

1. Medical Waste:
   a. Environmental Management Services will remove any waste, including sharps containers (for used needles and syringes), from construction areas prior to the start of projects.
   b. If you (contract workers) find any needles, syringes, sharp medical objects. Do not touch them. Please notify the COTR, who will notify Infection Control.

2. Barrier Walls:
   a. The construction areas MUST be kept separated from patient care areas by barriers that keep the dust and dirt inside the worksite.
   b. The walls must provide a complete seal of the construction area from adjacent areas (walls may be rigid or 4 or 6 mil thickness plastic).

3. Environmental Control:
   a. Negative air pressure must be maintained within the construction area.
   b. Demolition debris is removed in tightly fitted covered carts - use specified traffic patterns.
   c. Sticky or walk-off mats are placed immediately outside the construction zone and changed whenever necessary to control the spread of dust and dirt.
   d. Exterior window seals are to be used to reduce the amount of outside excavation debris coming into the building.

e. If demolition chutes are used, they must be sealed when not in use; the chute and damper should be sprayed with water, as necessary to maintain dust control.

f. Control, collection and disposal must be provided for any drain liquid or sludge found when demolishing plumbing.

4. Traffic Control:
   a. Use designated entry and exit procedures.
   b. Keep all pathways free from debris.
   c. No unauthorized personnel should be allowed to enter construction areas.
   d. Use designated elevators only.

5. Cleaning:
   a. Keep the construction area clean on a DAILY basis.
   b. Dust and dirt MUST be kept to a minimum.

6. Workers:
   a. Clothing must be free of loose soil and debris when exiting the construction area.
   b. Use personal protective equipment (masks, face shields, etc.) as indicated for the task at hand.
   c. Handwashing is the best method of reducing the transmission of infection: always wash your hands with soap and water after visiting the restroom, before eating, and when leaving the construction site.

-END OF SECTION-

Fire/ Smoke Barrier Penetration Permit WG
(Bill) Hefner VA Medical Center

I. PURPOSE: To provide guidance for maintenance and restoration of the integrity of all walls such: all smoke and fire barriers to include all pipe chases, floor slabs and corridor walls above and below the ceiling.

II. POLICY: This SOP establishes the assurance that any time a penetration is made in any space {smoke barriers, fire barriers, pipe chases, OI&T closets, mechanical rooms {et-al}, floors and any walls above or below the ceiling} it shall be sealed to assure that smoke and fire will not spread to adjacent space. It is required by the NFPA Life Safety Code 101 that the integrity of all walls and floors are maintained to prevent the migration of smoke or fire. This includes all vertical {wall} and horizontal {floor} penetrations.

III. RESPONSIBILITIES: - The responsibility of assuring that all walls and floors are free of penetrations lies collectively with Facilities Management Service (FMS), Office of Information and Technology (OI&T), Police Service. All will be responsible for assuring that when fire barriers and smoke barriers, floor and walls are breeched by work necessitating penetrations are to be sealed with approved fire caulk as listed in paragraph IV par "a" below.

a. *FMS, Police and OI&T:* – All walls and floors are to be considered as fire/smoke barrier partitions. If penetrations are made by *FMS, Police and OI&T* staff they must be sealed with approved fire caulking material to assure smoke and fire proof integrity at close of business. *FMS, Police and OI&T* will assure that this critical step is done. See Attach "A".

b. *Contractors* – All contractors who must perform work on fire/smoke barrier partitions et-al as indicated above are responsible to seal them with approved fire caulking material and assure smoke and fire integrity. See Attach "A".

c. *Contracting Officers Technical Representative (COTR)* – All FMS, OI&T, Police staffs who are COTR's on projects that necessitate the breeching of fire & smoke barriers shall have the duty of assuring that the vendors/contractors performing the work shall correctly seal all penetrations. The COTR responsible shall include this requirement in all projects at this Medical Center. See Attach "A".

IV PROCEDURES: - Prior to making any penetrations, the individual performing the work will obtain the Barrier Penetration Permit from Safety. Any time construction requires penetration through a smoke or fire barrier, pipe chase any wall or floor in order to route conduit, communication cables, piping for various utilities through the barrier, this must be sealed with approved fire proofing material. Other materials such as fiber glass insulation, rock-wool insulation, drywall compound is not compliant. If the penetration is made in order to route conduit or piping through the barrier, a seal preventing the migration of smoke or fire must be made around the materials that pass through the fire and smoke barrier to include all floor penetrations and wall penetrations. This shall be done with a suitable fire stopping material.

a. Only the following types of fire stopping material shall be acceptable:
   1. Hilti Brand:

i. FIRE STOP PUTTY STICK CP-618
ii. FIRE CAULK FS-0NE 259579
iii. FIRE PLUG CP-658T 378288
iv. FIRE STOP MORTAR CP-637
v. FIRE STOP BOARD CP-6755

2. 3M BRAND
   i. BLUE FIRE CAULK FD-150+

b. Proof of material used must be verified prior to use. This will be filed with the permit. See Attach "D".

c. Work Area Pre-Inspection:
   1. Check both sides of barrier for safety and to ensure no utilities or obstructions.
   2. Check for need to cover smoke heads, or disable devices in immediate area.
   3. Establish ILSM if work will be longer than close of business when permit is granted.
   4. Workable and appropriate fire extinguishers are in work area.

d. Issuing Permit: {Refer to Attach D}
   1. One copy will be made for the requestor; the original kept by issuing office to be returned to Safety.

e. Closing out Permit: {Refer to Attach D}
   1. All permitted work will be inspected for closeout by the issuing manager and the requestor at the end of each work day.
   2. All penetrations/breeches made fire or smoke barriers, walls and floors must be filled with fireproof material prior to requestor leaving for the day.
   3. Complete the appropriate sections of the permit on the original page.
   4. Copy/print original for the issuing manager and send original to FMS, Safety Manager.
      a. This can be scanned in to be sent email, or sending a hard copy

_____	_____	_____
Peter R Bader	Steve Elliott	Deborah Gunn
Ch. FMS	Ch. Police	Ch. OI&T
Date:_____		

Attachment D

Fire/ Smoke Barrier Penetration Permit
WG (Bill) Hefner VA Medical Center
Standard Operating Procedure # 138-999

Date: _____ **Building:** _____ **Location:** _____

Nature of work to be done: _____

Material to pass through: _____

Comments: _____

PERMISSION GRANTED

VA Shop: _____ **Contractor:** _____

Name/Title: _____ **Name/Title:** _____

Time started: _____

Permission granted by: _____ **Representing:**_____

CLOSE OUT

Penetration sealed with approved Fire Caulking: Y_____ N_____

If not; must be sealed prior to closing out this permit and by end of day.

Time Complete/Accepted: _____

Closed out by: _____ **Representing:**_____

Follow up Issues identified during inspection:

_____

THIS PERMIT SHALL BE KEPT ON FILE IN SAFETY B-21-B.

- **Photo copy for requestor.**
- **Original for Safety Manager, Fire Safety, COTR *or designee***

ATTACHMENT: D

Employee _____ **Contractor** _____

REQUEST APPROVAL

Purpose of work to be done:

_____

Describe material passing thru barrier: i.e.: cable, conduit, pipe, duct

_____

Type of barrier wall:
- ☐ **Smoke barrier**
- ☐ **One-hour fire barrier**
- ☐ **Two-hour fire barrier**
- ☐ **Non-rated wall**

New penetration or reopening of existing penetration: _____

Employee _____ **Contractor** _____

Safety Manager *or designee* grants permission to perform this work:
Name/Title_____
Date_____
Time started: _____

CLOSE OUT/INSPECTION

Penetration sealed with approved Fire Caulking: Y_____ **N**_____
If not; must be sealed prior to closing out this permit.

***Safety Manager or designee: f*inal inspection completed by:**
Name/Title_____
Date_____
Time ended: _____

Date: _____
Building, _____
Floor, _____
Room #, _____

Follow up Issues identified during inspection:
_____
_____

THIS PERMIT SHALL BE KEPT ON FILE IN SAFETY MANAGEMENT.
This permit is required for any penetrations to smoke or fire barrier, pipe chase, any wall or floor throughout the W.G. (Bill) Hefner VA Medical Center.

Stairwell #, _____
Floor, _____
Service/function: _____

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

1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.

1-2. For the purposes of this contract, samples (including laboratory samples to be tested), test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.

1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:

A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;

B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;

C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.

1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals (including any laboratory samples to be tested) will not serve as a basis for extending contract time for completion.

1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by COR on behalf of the Contracting Officer.

1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.

1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional

submittals beyond those required by the contract are furnished pursuant to request therefor by 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 Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect- Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.

1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.

A. Submit samples required by Section 09 06 00, SCHEDULE FOR FINISHES, in quadruplicate. Submit samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.

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

1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.

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

D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.

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

requested for return by Contractor will be discarded after completion of contract.

F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
   1. For each drawing required, submit one legible photographic paper or vellum reproducible.
   2. Reproducible shall be full size.
   3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
   4. A space 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 Architect-Engineer under one cover.

1-10. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the COR.

1-11. Samples (except laboratory samples) for approval shall be sent to in care of COR, VA Medical Center,

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SECTION 01 42 19
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:

DEPARMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
425 Eye Street N.W, (sixth floor)
Washington, DC 20001
Telephone Numbers: (202) 632-5249 or (202) 632-5178
Between 9:00 AM - 3:00 PM

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

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA Aluminum Association Inc.
http://www.aluminum.org

AABC Associated Air Balance Council
http://www.aabchq.com

AAMA American Architectural Manufacturer's Association
http://www.aamanet.org

AAN American Nursery and Landscape Association
http://www.anla.org

AASHTO American Association of State Highway and Transportation Officials
http://www.aashto.org

AATCC American Association of Textile Chemists and Colorists
http://www.aatcc.org

ACGIH American Conference of Governmental Industrial Hygienists
http://www.acgih.org

ACI American Concrete Institute
http://www.aci-int.net

ACPA American Concrete Pipe Association
http://www.concrete-pipe.org

ACPPA American Concrete Pressure Pipe Association
http://www.acppa.org

ADC Air Diffusion Council
http://flexibleduct.org

AGA American Gas Association
http://www.aga.org

AGC Associated General Contractors of America
http://www.agc.org

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

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

CTI	Cooling Technology Institute http://www.cti.org
DHI	Door and Hardware Institute http://www.dhi.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EEI	Edison Electric Institute http://www.eei.org
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.et1.com
FAA	Federal Aviation Administration http://www.faa.gov
FCC	Federal Communications Commission http://www.fcc.gov
FPS	The Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.cssinfo.com/info/gana.html/
FM	Factory Mutual Insurance http://www.fmglobal.com
GA	Gypsum Association http://www.gypsum.org
GSA	General Services Administration http://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
HPVA	Hardwood Plywood & Veneer Association http://www.hpva.org

ICBO International Conference of Building Officials
http://www.icbo.org

ICEA Insulated Cable Engineers Association Inc.
http://www.icea.net

\ICAC Institute of Clean Air Companies
http://www.icac.com

IEEE Institute of Electrical and Electronics Engineers
http://www.ieee.org\

IMSA International Municipal Signal Association
http://www.imsasafety.org

IPCEA Insulated Power Cable Engineers Association

NBMA Metal Buildings Manufacturers Association
http://www.mbma.com

MSS Manufacturers Standardization Society of the Valve and Fittings Industry Inc.
http://www.mss-hq.com

NAAMM National Association of Architectural Metal Manufacturers
http://www.naamm.org

NAPHCC Plumbing-Heating-Cooling Contractors Association
http://www.phccweb.org.org

NBS National Bureau of Standards
See - NIST

NBBPVI National Board of Boiler and Pressure Vessel Inspectors
http://www.nationboard.org

NEC National Electric Code
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association
http://www.nema.org

NFPA National Fire Protection Association
http://www.nfpa.org

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

UL	Underwriters' Laboratories Incorporated http://www.ul.com
ULC	Underwriters' Laboratories of Canada http://www.ulc.ca
WCLIB	West Coast Lumber Inspection Bureau 6980 SW Varns Road, P.O. Box 23145 Portland, OR 97223 (503) 639-0651
WRCLA	Western Red Cedar Lumber Association P.O. Box 120786 New Brighton, MN 55112 (612) 633-4334
WWPA	Western Wood Products Association http://www.wwpa.org

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SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor.

1.2 APPLICABLE PUBLICATIONS:

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

B. American Association of State Highway and Transportation Officials (AASHTO):

T27-06.....Sieve Analysis of Fine and Coarse Aggregates

T96-02 (R2006).....Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

T99-01 (R2004).....The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2003).....Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-01 (R2004).....Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

T191-02(R2006).....Density of Soil In-Place by the Sand-Cone Method

C. American Concrete Institute (ACI):

506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete

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

A325-06.....Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A370-07.....Definitions for Mechanical Testing of Steel Products

A416/A416M-06.....Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

A490-06.....Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

C31/C31M-06.....Making and Curing Concrete Test Specimens in the Field

C33-03.....Concrete Aggregates

C39/C39M-05.....Compressive Strength of Cylindrical Concrete Specimens
C109/C109M-05.....Compressive Strength of Hydraulic Cement Mortars
C138-07.....Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C140-07.....Sampling and Testing Concrete Masonry Units and Related Units
C143/C143M-05.....Slump of Hydraulic Cement Concrete
C172-07.....Sampling Freshly Mixed Concrete
C173-07.....Air Content of freshly Mixed Concrete by the Volumetric Method
C330-05.....Lightweight Aggregates for Structural Concrete
C567-05.....Density Structural Lightweight Concrete
C780-07.....Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019-08.....Sampling and Testing Grout
C1064/C1064M-05.....Freshly Mixed Portland Cement Concrete
C1077-06.....Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C1314-07.....Compressive Strength of Masonry Prisms
D698-07.....Laboratory Compaction Characteristics of Soil Using Standard Effort
D1143-07.....Piles Under Static Axial Compressive Load
D1188-07.....Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D1556-07.....Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557-07.....Laboratory Compaction Characteristics of Soil Using Modified Effort
D2166-06.....Unconfined Compressive Strength of Cohesive Soil
D2167-94(R2001).....Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2216-05.....Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2922-05.....Density of soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D2974-07.....Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-(2002).....Minimum Requirements for Agencies Testing and Inspection Bituminous Paving Materials
D3740-07.....Minimum Requirements for Agencies Engaged in the Testing and Inspecting Road and Paving Material
E94-04.....Radiographic Testing
E164-03.....Ultrasonic Contact Examination of Weldments
E329-07.....Agencies Engaged in Construction Inspection and/or Testing
E543-06.....Agencies Performing Non-Destructive Testing
E605-93(R2006).....Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
E709-(2001).....Guide for Magnetic Particle Examination
E1155-96(R2008).....Determining FF Floor Flatness and FL Floor Levelness Numbers

E. American Welding Society (AWS):
D1.1-07.....Structural Welding Code-Steel

1.3 REQUIREMENTS:

A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory’s scope of accreditation must include the appropriate ASTM standards (i.e.; E 329, C 1077, D 3666, D3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the “Corporate Office.”

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COR to such failure.

C. Written Reports: Testing laboratory shall submit test reports to COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to COR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:

1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COR extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.

2. Provide full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.

B. Testing Compaction:

1. ASTM D698 and/or ASTM D1557.
2. Make field density tests in accordance with the primary testing method following ASTM D2922 wherever possible. Field density tests utilizing ASTM D1556 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COR before the tests are conducted.
   a. Pavement Subgrade: One test for each 335 m^2 (400 square yards), but in no case fewer than two tests.
   b. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
   c. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.

D. Testing Materials: Test suitability of on-site and off-site borrow as directed by COR.

3.4 LANDSCAPING:

A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
   1. Test for organic material by using ASTM D2974.
   2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.

B. Submit laboratory test report of topsoil to COR.

3.5 ASPHALT CONCRETE PAVING:

A. Aggregate Base Course:
   1. Determine maximum density and optimum moisture content for aggregate base material in accordance with ASTM D1557, Method D
   2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with ASTM D1556.
   3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable NCDOT highway standards and specifications.

B. Asphalt Concrete:
   1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
   2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
   3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

3.6 SITE WORK CONCRETE:

Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

3.7 POST-TENSIONING OF CONCRETE:

A. Inspection Prior to Concreting: Inspect tendons, drape of tendons, and anchorage components for compliance prior to concreting.

B. Concrete Testing: As required in Article, CONCRETE of this section except make three test cylinders representing each area to be tensioned and cylinders shall be cured in same manner as concrete they represent. Make compression test prior to determining minimum specified strength required for post-tensioning.

C. Post-tensioning: Witness post-tensioning operation and record actual gauge pressures and elongations applied to each tendon.

D. Submit reports in quadruplicate of the following:
   1. Inspection of placement and post-tensioning of all tendons.
   2. Size, number, location, and drape of tendons.
   3. Calculated elongations, based upon the length, modulus of elasticity, and cross-sectional area of the tendons used.
   4. Actual field elongations. Check elongation of tendons within ranges established by manufacturer.
   5. Calculated gauge pressure and jacking force applied to each tendon.
   6. Actual gauge pressures and jacking force applied to each tendon.
   7. Required concrete strength at time of jacking.
   8. Actual concrete strength at time of jacking.
   9. Do not cut or cover the tendon ends until the Contractor receives the COR’s written approval of the post-tensioning records.

3.8 CONCRETE:

A. Batch Plant Inspection and Materials Testing:
   1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COR.
   2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.
   3. Sample and test mix ingredients as necessary to insure compliance with specifications.
   4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
   5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:
   1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
   2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered

is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor’s expense. Any rejected concrete that is placed will be subject to removal.

3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m^3 (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. COR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day’s pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m^3 (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m^3 (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
    a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
    b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind

velocity; record maximum temperature of surface of hardened concrete.

11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:
    a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
    b. Inspect preparation of construction, expansion, and isolation joints.
16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
    a. Monitor and record amount of water added at project site.
    b. Observe minimum and maximum mixing times.
18. Measure concrete flatwork for levelness and flatness as follows:
    a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
    b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
    c. Provide the Contractor and the COR with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
19. Other inspections:
    a. Grouting under base plates.
    b. Grouting anchor bolts and reinforcing steel in hardened concrete.

C. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COR. Compile laboratory test reports as follows:

Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.

2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to COR. In test report, indicate the following information:
   a. Cylinder identification number and date cast.
   b. Specific location at which test samples were taken.
   c. Type of concrete, slump, and percent air.
   d. Compressive strength of concrete in MPa (psi).
   e. Weight of lightweight structural concrete in kg/m^3 (pounds per cubic feet).
   f. Weather conditions during placing.
   g. Temperature of concrete in each test cylinder when test cylinder was molded.
   h. Maximum and minimum ambient temperature during placing.
   i. Ambient temperature when concrete sample in test cylinder was taken.
   j. Date delivered to laboratory and date tested.

3.9 REINFORCEMENT:

A. Review mill test reports furnished by Contractor.

B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.

B. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.

C. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

EP-1. DESCRIPTION

A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.

B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
   1. Adversely effect human health or welfare,
   2. Unfavorably alter ecological balances of importance to human life,
   3. Effect other species of importance to humankind, or;
   4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.

C. Definitions of Pollutants:
   1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
   2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
   3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
   4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
   5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
   6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

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

EP-2. QUALITY CONTROL

A. Establish and maintain quality control for the environmental protection of all items set forth herein.

B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

EP-3. REFERENCES

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

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

EP-4. SUBMITTALS

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

1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Resident Engineer to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Resident Engineer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
   a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
   b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
   C. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
   d. Description of the Contractor's environmental protection personnel training program.
   e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.

g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.

h. Permits, licenses, and the location of the solid waste disposal area.

i. Environmental Monitoring Plans for the job site including land, water, air, and noise.

j. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.

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

EP-5. PROTECTION OF ENVIRONMENTAL RESOURCES

A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.

B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the Resident Engineer. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.

1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.

2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be

preserved by marking, fencing, or using any other approved techniques.

a. Box and protect from damage existing trees and shrubs to remain on the construction site.
b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.

3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
5. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
6. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
7. Handle discarded materials other than those included in the solid waste category as directed by the Resident Engineer.

C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.

1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.

3. Monitor water areas affected by construction.

D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.

E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of North Carolina and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Resident Engineer. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m unless otherwise permitted by local ordinance or the Resident Engineer. Repetitive impact noise on the property shall not exceed the following dB limitations:

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

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
   a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	PNEUMATIC TOOLS	80
PAVERS, STATIONARY	80	SAWS	75
PUMPS	75	VIBRATORS	75
GENERATORS	75		
COMPRESSORS	75		

   b. Use shields or other physical barriers to restrict noise transmission.
   c. Provide soundproof housings or enclosures for noise-producing machinery.
   d. Use efficient silencers on equipment air intakes.
   e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
   f. Line hoppers and storage bins with sound deadening material.
   g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being

performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the Resident Engineer noting any problems and the alternatives for mitigating actions.

G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.

H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the Resident Engineer. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.

B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.

C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:

1. Waste Management Plan development and implementation.
2. Techniques to minimize waste generation.
3. Sorting and separating of waste materials.
4. Salvage of existing materials and items for reuse or resale.
5. Recycling of materials that cannot be reused or sold.

D. At a minimum the following waste categories shall be diverted from landfills:

1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, copper, etc).
7. Cardboard, paper and packaging.
8. Bitumen roofing materials.
9. Plastics (eg, ABS, PVC).
10. Carpet and/or pad.
11. Gypsum board.
12. Insulation.
13. Paint.
14. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

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

B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.

C. Contractor shall develop and implement procedures to reuse and recycle new materials to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website http://www.wbdg.org provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

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

1.4 TERMINOLOGY

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

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
   1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
   2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.

M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.

O. Return: To give back reusable items or unused products to vendors for credit.

P. Salvage: To remove waste materials from the site for resale or re-use by a third party.

Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.

S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

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

B. Prepare and submit to the 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.

- - - E N D - - -

SECTION 05 50 00
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. Frames: (24E)
3. Guards
4. Covers and Frames for Pits and Trenches.
5. Gratings
6. Loose Lintels
7. Shelf Angles
8. Gas Racks
9. Plate Door Sill
10. Safety Nosings
11. Ladders
12. Railings: (10)
13. Catwalks and Platforms
14. Trap Doors with Ceiling Hatch
15. Sidewalk Access Doors
16. Screened Access Doors
17. Steel Counter or Bench Top Frame and Leg

1.2 RELATED WORK

A. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.

B. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.

C. Prime and finish painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

Grating, each type	Floor plate
Trap door	Wheel guards
Ceiling hatch	Sidewalk Access door
Manhole Covers	Safety nosing

C. 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.
D. Manufacturer's Certificates:
   1. Anodized finish as specified.
   2. Live load designs as specified.
E. Design Calculations for specified live loads including dead loads.
F. 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(R1997).....Wood Screws
   B18.2.2-87(R2005).....Square and Hex Nuts
C. American Society for Testing and Materials (ASTM):
   A36/A36M-05.....Structural Steel
   A47-99(R2004).....Malleable Iron Castings
   A48-03.....Gray Iron Castings

A53-06.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123-02.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

A269-07.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A307-07.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

A312/A312M-06.....Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

A391/A391M-01.....Grade 80 Alloy Steel Chain

A653/A653M-07.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

A786/A786M-05.....Rolled Steel Floor Plate

B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B456-03.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

B632-02.....Aluminum-Alloy Rolled Tread Plate

C1107-07.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

D3656-04.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

F436-07.....Hardened Steel Washers

F468-06.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

F593-02.....Stainless Steel Bolts, Hex Cap Screws, and Studs

F1667-05.....Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):

D1.1-04.....Structural Welding Code Steel

D1.2-03.....Structural Welding Code Aluminum

D1.3-98.....Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)

AMP521-01.....Pipe Railing Manual

AMP 500-505-1988.....Metal Finishes Manual

MBG 531-00.....Metal Bar Grating Manual

MBG 532-00.....Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC):

SP 1-05.....No. 1, Solvent Cleaning

SP 2-05.....No. 2, Hand Tool Cleaning

SP 3-05.....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. Floor Plates, Gratings, Covers, Trap Doors, Catwalks, and Platforms: 500 kg/m^2 (100 pounds per square foot). Use 300 kg (pounds) for concentrated loads.

E. Manhole Covers: 1200 kg/m^2 (250 pounds per square foot).

2.2 MATERIALS

A. Structural Steel: ASTM A36.

B. Stainless Steel: ASTM A167, Type 302 or 304.

C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.

D. Floor Plate:

1. Steel ASTM A786.
2. Aluminum: ASTM B632.

E. Steel Pipe: ASTM A53.

1. Galvanized for exterior locations.
2. Type S, Grade A unless specified otherwise.
3. NPS (inside diameter) as shown.

F. Cast-Iron: ASTM A48, Class 30, commercial pattern.

G. Malleable Iron Castings: A47.

H. Primer Paint: As specified in Section 09 91 00, PAINTING.

I. Stainless Steel Tubing: ASTM A269, type 302 or 304.

J. Modular Channel Units:

1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
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.

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

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. 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.
   d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. 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. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
   h. 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 preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
   b. 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. Aluminum: NAAMM AMP 501.
   a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
   b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
   c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
   d. Painted: AA-C22R10.
3. 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 09 91 00, PAINTING.
2) Non ferrous metals: Comply with MAAMM-500 series.
4. Stainless Steel: NAAMM AMP-504 Finish No. 4.
5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
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 Ceiling Hung Toilet Stall:
1. Use a continuous steel channel above pilasters with hangers centered over pilasters.

2. Make provision for installation of stud bolts in lower flange of channel.
3. Provide a continuous steel angle at wall and channel braces spaced as shown.
4. Use threaded rod hangers.
5. Provide diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.

C. For Wall Mounted Items:
1. For items supported by metal stud partitions.
2. Steel strip or hat channel 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 flatted 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.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

D. For Trapeze Bars:
1. Construct assembly above ceilings as shown and design to support not less than a 340 kg (750 pound) working load at any point.
2. Fabricate trapeze supports as shown, with all exposed members, including screws, nuts, bolts and washers, fabricated of stainless steel.
3. Fabricate concealed components of structural steel shapes unless shown otherwise.
4. Stainless steel ceiling plate drilled for eye bolt.
5. Continuously weld connections where welds shown.
6. Use modular channel where shown with manufacturers bolts and fittings.
   a. Weld ends of steel angle braces to steel plates and secure to modular channel units as shown. Drill plates for anchor bolts.
   b. Fabricate eye bolt, special clamp bolt, and plate closure full length of modular channel at ceiling line and secure to modular channel unit with manufacturers standard fittings.

E. For Intravenous Track and Cubical Curtain Track:
1. Fabricate assembly of steel angle as shown.

2. Drill angle bent ends for anchor screws to acoustical suspension system and angle for hanger wires.
3. Provide pipe sleeve welded to angle.

F. Supports at Ceiling for Radiographic (x-ray) Equipment:
1. Fabricate hangers braces, and track of modular channel units assembly as shown.
2. Fabricate steel plates for anchor to structure above.
3. Drill bent plates for bolting at mid height at concrete beams.

G. For Operating Room Light:
1. Fabricate as shown to suit equipment furnished.
2. Drill leveling plate for light fixture bolts.

H. Supports in Orthopedic Brace Shop:
1. Fabricate from 25 mm (one inch) steel pipe, fasten to steel angles above and extend to a point 150 mm (6 inches) below finished ceiling.
2. Lower end of the pipe shall have a standard pipe thread.
3. Provide an escutcheon plate at ceiling.

I. Supports for Accordion Partition Tracks, Exercise Equipment, and Items at Various Conditions at Suspended Ceilings:
1. Fabricate of structural steel shapes as shown.
2. Drill for anchor bolts of suspended item.

J. Supports for Communion Rail Posts in Chapel:
1. Fabricate one steel plate support for each post as shown.
2. Drill for fasteners.

2.6 FRAMES

A. Elevator Entrance Wall Opening.
1. Fabricate of channel shapes, plates, and angles as shown.
2. Weld or bolt head to jamb as shown.
3. Weld clip angles to bottom of frame and top of jamb members extended to structure above for framed construction.
   a. Provide holes for anchors.
   b. Weld head to jamb members.

B. Channel Door Frames:
1. Fabricate of structural steel channels of size shown.
2. Miter and weld frames at corners.
3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch) wide steel strap anchors with ends turned 50 mm (2 inches), and of

sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.

4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
5. Where closure plates are shown, continuously weld them to the channel flanges.
6. Weld continuous 19 x 19 x 3 mm (3/4 x 3/4 x 1/8 inch) thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
7. Prepare frame for installation of hardware specified in Section 08 71 00, DOOR HARDWARE.
   a. Cut a slot in the lock jamb to receive the lock bolt.
   b. Where shown use continuous solid steel bar stops at perimeter of frame, weld or secure with countersunk machine screws at not more than 450 mm (18 inches) on center.

C. Frames for Breech Opening:
1. Fabricate from steel channels, or combination of steel plates and angles to size and contour shown.
2. Weld strap anchors on back of frame at not over 600 mm (2 feet) on centers for concrete or masonry openings.

D. 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 GUARDS

A. Wall Corner Guards:
   1. Fabricate from steel angles and furnish with anchors as shown.
   2. Continuously weld anchor to angle.

B. Guard Angles for Overhead Doors:
   1. Cut away top portion of outstanding leg of angle and extend remaining portion of angle up wall.
   2. Weld filler piece across head of opening to jamb angles.
   3. Make provisions for fasteners and anchorage.

C. Channel Guard at Loading Platform:
   1. Fabricate from steel channel of size shown.
   2. Weld anchors to channels as shown.
   3. Drill channel for bumper anchor bolts.

D. Edge Guard Angles for Openings in slabs.
   1. Fabricate from steel angles of sizes and with anchorage shown.
   2. Where size of angle is not shown, provide 50 x 50 x 6 mm (2 x 2 x 1/4 inch) steel angle with 32 x 5 mm (1-1/4 x 3/16 inch) strap anchors, welded to back.
   3. Miter or butt angles at corners and weld.
   4. Use one anchor near end and three feet on centers between end anchors.

E. Wheel Guards:
   1. Construct wheel guards of not less than 16 mm (5/8 inch) thick cast iron.
   2. Provide corner type, with flanges for bolting to walls.

2.8 COVERS AND FRAMES FOR PITS AND TRENCHES

A. Fabricate covers to support live loads specified.

B. Galvanized steel members after fabrication in accordance with ASTM A123, G-90 coating.

C. Steel Covers:

1. Use 6 mm (1/4 inch) thick floor plate for covers unless otherwise shown. Use gratings where shown as specified in paragraph GRATINGS. Use smooth floor plate unless noted otherwise.
2. Provide clearance at all sides to permit easy removal of covers.
3. Make cutouts within 6 mm (1/4 inch) of penetration for passage of pipes and ducts.
4. Drill covers for flat head countersunk screws.
5. Make cover sections not to exceed 2.3 m^2 (25 square feet) in area and 90 kg (200 pounds) in weight.
6. Fabricate trench cover sections not be over 900 mm (3 feet) long and if width of trench is more than 900 mm (3 feet)or over, equip one end of each section with an angle or "T" bar stiffener to support adjoining plate.
7. Use two, 13 mm (1/2 inch) diameter steel bar flush drop handles for each cover section.

D. Cast Iron Covers

1. Fabricate covers to support live loads specified.
2. Fabricate from ASTM A48, cast-iron, 13 mm (1/2 inch) minimum metal thickness, cast with stiffeners as required.
3. Fabricate as flush type with frame, reasonably watertight and be equipped with flush type lifting rings. Provide seals where watertight covers noted.
4. Make covers in sections not over 90 kg (200 pounds) except round covers.

E. Steel Frames:

1. Form frame from structural steel angles as shown. Where not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles for frame openings over 1200 mm (4 feet) long and 50 x 50 x 6 mm (2 ix 2 x 1/4 inch) for frame openings less than 1200 mm (4 feet).
2. Fabricate intermediate supporting members from steel "T's" or angles; located to support cover section edges.
3. Where covers are required use steel border bars at frames so that top of cover will be flush with frame and finish floor.

4. Weld steel strap anchors to frame. Space straps not over 600 mm (24 inches) o.c., not shown otherwise between end anchors. Use 6 x 25 x 200 mm (1/4 x 1 x 8 inches) with 50 mm (2 inch) bent ends strap anchors unless shown otherwise.
5. Drill and tap frames for screw anchors where plate covers occur.

F. Cast Iron Frames:
1. Fabricate from ASTM A48 cast iron to shape shown.
2. Provide anchors for embedding in concrete, spaced near ends and not over 600 mm (24 inches) apart.

2.9 GRATINGS

A. Fabricate gratings to support live loads specified and a concentrated load as specified.
B. Provide clearance at all sides to permit easy removal of grating.
C. Make cutouts in gratings with 6 mm (1/4 inch) minimum to 25 mm (one inch) maximum clearance for penetrations or passage of pipes and ducts. Edge band cutouts.
D. Fabricate in sections not to exceed 2.3 m^2 (25 square feet) in area and 90 kg (200 pounds) in weight.
E. Fabricate sections of grating with end-banding bars.
F. Fabricate angle frames and supports, including anchorage as shown.
1. Fabricate intermediate supporting members from "T's" or angles.
2. Locate intermediate supports to support grating section edges.
3. Fabricate frame to finish flush with top of grating.
4. Locate anchors at ends and not over 600 mm (24 inches) o.c.
5. Butt or miter, and weld angle frame at corners.

G. Steel Bar Gratings:
1. Fabricate grating using steel bars, frames, supports and other members shown in accordance with Metal Bar Grating Manual.
2. Galvanize steel members after fabrication in accordance with ASTM A123, G-90 for exterior gratings, gratings in concrete floors, and interior grating where specified.
3. Interior gratings: Prime paint unless specified galvanized.

H. Aluminum Bar Gratings:
1. Fabricate grating and frame assembly from aluminum as shown in accordance with Metal Bar Grating Manual.
2. Use 25 x 5 mm (1 x 3/16 inch) minimum size bearing bars.
3. Mill finish unless specified otherwise.

I. Plank Gratings:

1. Conform to Fed. Spec. RR-G-1602.
2. Manufacturers standard widths, lengths and side channels to meet live load requirements.
3. Galvanize exterior steel gratings ASTM A123, G-90 after fabrication.
4. Fabricate interior steel gratings from galvanized steel sheet, ASTM A525, where bearing on concrete or masonry.
5. Fabricate other interior grating from steel sheet and finish with shop prime paint. Prime painted galvanized sheet may be used.

J. Cast Iron Gratings:
1. Fabricate gratings to support a live load of 23940 Pa (500 pounds per square foot).
2. Fabricate gratings and frames for gutter type drains from cast-iron conforming to ASTM A48.
3. Fabricate gratings in section not longer than 1200 mm (4 feet) or over 90 kg (200 pounds) and fit so as to be readily removable.

2.10 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.

I. Elevator Entrance:

1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 100 mm (4 inch) bearing each end.
2. Cut away the front leg of the channel at each end to allow for concealment behind elevator hoistway entrance frame.

2.11 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.

2.12 PLATE DOOR SILL

A. Fabricate of checkered plate as detailed.
   1. Aluminum Plate: ASTM B632, 3 mm (0.125 inch) thick.
   2. Steel Plate: ASTM A786, 3 mm (0.125 inch thick), galvanized G90.

B. Fabricate for anchorage with flat head countersunk bolts at each end and not over 300 mm (12 inches), o.c.

2.13 SAFETY NOSINGS

A. Fed. Spec. RR-T-650, Type C.
   1. Aluminum: Class 2, Style 2.
   2. Cast iron: Class 4.

B. Fabricate nosings for exterior use from cast aluminum, and nosings for interior use from either cast aluminum or cast iron. Use one Class throughout.

C. Fabricate nosings approximately 100 mm (4 inches) wide with not more than 9 mm (3/8 inch) nose.

D. Provide nosings with integral type anchors spaced not more than 100 mm (4 inches) from each end and intermediate anchors spaced approximately 375 mm (15 inches) on center.

E. Fabricate nosings to extend within 100 mm (4 inches) of ends of concrete stair treads except where shown to extend full width.

F. Fabricate nosings to extend full width between stringers of metal stairs and full width of door openings.

G. On curved steps fabricate to terminate at point of curvature of steps having short radius curved ends.

2.14 LADDERS

A. Steel Ladders:

1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
2. Fabricate angle brackets of 50 mm (2 inch) wide by 13 mm (1/2 inch) thick steel; brackets spaced maximum of 1200 mm (4 feet) apart and of length to hold ladder 175 mm (7 inches) from wall to center of rungs. Provide turned ends or clips for anchoring.
3. Provide holes for anchoring with expansion bolts through turned ends and brackets.
4. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.
5. Galvanize exterior ladders after fabrication, ASTM A123, G-90.

SPEC WRITER NOTE: Verify details, show size and dimensions of components, or specify.

B. Aluminum Ladders:
1. Fixed-rail type, constructed of structural aluminum, with mill finish.
2. Fabricate side rails and rungs of size and design shown, with the rungs shouldered and headed into and welded to the rails.
3. Where shown fabrication side rails curved, twisted and formed into gooseneck.
4. Fabricate angle brackets at top and bottom and intermediate brackets where shown. Drill for bolting.

C. Ladder Rungs:
1. Fabricate from 25 mm (one inch) diameter steel bars.
2. Fabricate so that rungs will extend at least 100 mm (4 inches) into wall with ends turned 50 mm (2 inches), project out from wall 175 mm (7 inches), be 400 mm (16 inches) wide and be designed so that foot cannot slide off end.
3. Galvanized after fabrication, ASTM A123, G-90 rungs for exterior use and for access to pits.

2.15 RAILINGS

A. In addition to the dead load design railing assembly to support live load specified.

B. Fabrication General:
1. Provide continuous welded joints, dressed smooth and flush.
2. Standard flush fittings, designed to be welded, may be used.
3. Exposed threads will not be approved.

4. Form handrail brackets to size and design shown.
5. Exterior Post Anchors.
   a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
   b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
   c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts.
6. Interior Post Anchors:
   a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
   b. Weld or thread flanged fitting to posts at base.
   c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
   d. Provide sliding flange base plate on posts secured with set screws.
   e. Weld flange base plate to removable posts set in sleeves.

C. Handrails:
1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.

D. Steel Pipe Railings:
1. Fabricate of steel pipe with welded joints.
2. Number and space of rails as shown.
3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
4. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.
6. Removable Rails:
   a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
   b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.

c. Continuously weld brackets to post.
d. Provide slotted bolt holes in rail bracket.
e. Weld bolt heads flush with top of rail.
f. Weld flanged fitting to post where posts are installed in sleeves.

7. Opening Guard Rails:
   a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
   b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
   c. Fabricate rails for floor openings for anchorage in sleeves.
8. Gates:
   a. Fabricate from steel pipe as specified for railings.
   b. Fabricate gate fittings from either malleable iron or wrought steel.
   c. Hang each gate on suitable spring hinges of clamp on or through bolted type. Use bronze hinges for exterior gates.
   d. Provide suitable stops, so that gate will swing as shown.
9. Chains:
   a. Chains: ASTM A391, Grade 63, straight link style, normal size chain bar 8 mm (5/16 inch) diameter, eight links per 25 mm (foot) and with boat type snap hook on one end, and through type eye bolt on other end.
   b. Fabricate eye bolt for attaching chain to pipe posts, size not less than 9 mm (3/8 inch) diameter.
   c. Fabricate anchor at walls, for engagement of snap hook of either a 9 mm (3/8 inch) diameter eye bolt or punched angle.
   d. Galvanize chain and bolts after fabrication.

E. Aluminum Railings:
1. Fabricate from extruded aluminum.
2. Use tubular posts not less than 3 mm (0.125 inch) wall thickness for exterior railings.
3. Punch intermediate rails and bottom of top rails for passage of posts and machine to a close fit.
4. Where shown use extruded channel sections for top rail with 13 mm (1/2 inch) thick top cover plates and closed ends.
5. Fabricate brackets of extruded or wrought aluminum as shown.

6. Fabricate stainless pipe sleeves with closed bottom at least six inches deep having internal dimensions at least 13 mm (1/2 inch) greater than external dimensions of posts where set in concrete.

F. Stainless Steel Railings:

1. Fabricate from 38 mm (1-1/2 inches) outside diameter stainless steel tubing, ASTM A269, having a wall thickness of 1.6 mm (0.065 inch).
2. Join sections by an internal connector to form hairline joints where field assembled.
3. Fabricate with continuous welded connections.
4. Fabricate brackets of stainless steel to design shown.
5. Fabricate stainless steel sleeves at least 150 mm (6 inches) deep having internal dimensions at least 13 mm (1/2 inch) greater than external dimensions of post.

2.16 CATWALKS

A. Fabricate catwalks including platforms, railings, ladders, supports and hangers, and arrangement of members as shown on drawings.

B. Fabricate stairs as specified in Section 05 51 00, METAL STAIRS.

C. Fabricate steel ladders as specified under paragraph LADDERS unless shown otherwise.

D. Fabricate steel pipe railings as specified under paragraph RAILINGS.

E. Catwalk and platforms floor surfaces as shown.

1. Steel gratings as specified under paragraph gratings, either bar or plank type.
2. Steel floor plate.
3. Aluminum floor plate.

F. Prime paint catwalk system.

2.17 TRAP DOOR AND FRAMES WITH CEILING HATCH

A. Design to support a live load as specified.

B. Frames:

1. Fabricate steel angle frame to set in concrete slabs and design to set flush with finished concrete slab or curb. If not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles.
2. Miter steel angles at corners and weld together.
3. Weld steel bar stops to vertical leg of frame, to support doors flush with the top of the frame.
4. Weld steel strap anchors on each side not over 600 mm (24 inches) on center to the backs of the frames. If not shown use 6 x 50 x 200 mm (1/4 x 2 x 8 inch) long straps with 50 mm (2 inch bent) ends.

5. Form frames from steel angles with welded corners for reinforcing and bracing of well lining and support of ceiling hatch.

C. Covers:

1. Use 6 mm (1/4 inch) thick steel floor plate.
2. Where double leaf covers are shown, reinforce at meeting edges.
3. Use wrought steel hinges with fixed brass pins.
   a. Weld to cover.
   b. Secure to frame with machine screws.
4. Where ladders occur, install hinges on the side opposite the ladder.
5. Provide two bar type drop handles, flush with cover when closed for each leaf.

D. Well Lining:

1. Fabricate well linings, for access through concrete floor slabs and suspended ceilings, from hatch to ceiling hatch or ceiling openings.
2. Use steel sheet and shapes of size and thickness as shown. If not shown use 1.5 mm (0.0598 inch) thick steel sheet.
3. If not shown use 50 x 50 x 6 mm (2 x 2 x 1/4 inch) angle braces from ceiling level on each side angled at 45 degrees to structure above.
4. Use 25 x 25 x 3 mm (1 x 1 x 1/8 inch) angle bottom flange trim welded to well lining where no ceiling hatch occurs.

E. Ceiling Hatch:

1. Construct hatch with "T" or angle frame designed to support edge of ceiling and hatch, weld to well lining.
2. Form hatch panels of 3 mm (1/8 inch) steel, 5 mm (3/16 inch) aluminum or 1 mm (0.0359 inch) thick steel of pan type construction with 25 mm (one inch) of mineral fiber insulation between.
3. Use counter balance device, hinges, latch, hangers and other accessories required for installation and operation of hatch with not over 90 N (20 pounds) of force.
4. Fabricate panels flush and reinforced to remain flat.
5. Locate hatch panel flush with frame.

F. Finish with baked on prime coat.

2.18 SIDEWALK DOOR

A. Use flush, watertight, gutter type design.

B. Cover fabricate of 6 mm (1/4 inch) thick, diamond pattern floor plate.

C. Use automatic lock hold open feature and be hung on two flush type heavy bronze hinges capable of 90 degree swing on each door leaf.

D. Equip with locking and latching device and lifting devices; operable and accessible from both sides of doors.

E. Doors removable without disturbing frame.

F. Provide gutters at all joints for drainage of water.

2.19 SCREENED ACCESS DOORS AND FRAMES

A. Galvanized ASTM A123, G-90 after fabrication.

B. Wall frame:

1. Fabricate frame from steel angles or channels as shown.
2. Continuously weld 38 x 13 mm (1-1/2 x 1/2 inch) steel channel door stop to angle frame. Cut out lock strike opening in channel.
3. Miter and weld channel frame at corners. Reinforce corner with 3 mm (1/8 inch) plate angle.
4. Reinforce channel frame with 3 x 150 mm (1/8 x 6 inch) long steel plate at channel back to cutout for latch. Cutout lock strike opening in channel face. Drill and tap for hinge anchorage.
5. Drill jambs for 6 mm (1/4 inch) bolt anchors at top and bottom and not over 450 mm (18 inches) between top and bottom.
6. Fabricate frame for door to sit flush with face of frame.

C. Doors

1. Fabricate door using steel channel frame with 3 mm (1/8 inch) angle plate reinforcing at corners.
2. Miter and weld corners.
3. Fabricate lock box of 1.6 mm (1/16 inch) plate and weld to channel surround.
4. Provide wire mesh constructed of 3.5 mm (0.135 inch) diameter galvanized steel wire crimped and woven into 38 mm (1-1/2 inch) diamond mesh pattern. Fasten the wire mesh to door frames by bending the ends of each strand of wire over through channel clinched and welded to channel door frame.
5. Weld steel plate back-bands to channel door frame at hinge stiles only.
6. Screen on doors in exterior walls.
   a. Fabricate rewirable frame for screen from either extruded or tubular aluminum.
   b. Design to allow for removing or replacement frame and screening or adjoining items without damage.
   c. Use aluminum insect screening specified.
   d. Use stainless steel fasteners for securing screen to door.

D. Hardware:
   1. Install hinged door to fixed frame with two 63 mm (2-1/2 inch) brass or bronze hinges.
   2. Install lock or latch specified in Section 08 71 00, DOOR HARDWARE in lockbox.

2.20 STEEL COUNTER OR BENCH TOP FRAME AND LEGS

A. Fabricate channel or angle frame with mitered and welded corners as shown.
B. Drill top of frame with 6 mm (1/4inch) holes spaced 200 mm (8 inches) on center for securing countertop.
C. Fabricate legs of angle or pipe shapes and continuously weld to frame.
D. Finish frame with backed on enamel prime coat.

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. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
D. Field weld in accordance with AWS.
   1. Design and finish as specified for shop welding.
   2. Use continuous weld unless specified otherwise.
E. 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.
F. 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.
G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. 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. Ceiling Hung Toilet Stalls:

1. Securely anchor hangers of continuous steel channel above pilasters to structure above.
2. Bolt continuous steel angle at wall to masonry or weld to face of each metal stud.
3. Secure brace for steel channels over toilet stall pilasters to wall angle supports with bolts at each end spaced as shown.
4. Install diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.
5. Install stud bolts in lower flange of channel before installing furred down ceiling over toilet stalls.
6. Install support for ceiling hung pilasters at entrance screen to toilet room similar to toilet stall pilasters.

C. 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.

D. 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.

E. 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.

F. Supports for intravenous (IV) Track and Cubicle Curtain Track:
1. Install assembly where shown after ceiling suspension grid is installed.
2. Drill angle for bolt and weld nut to angle prior to installation of tile.

G. Support for cantilever grab bars:
1. Locate channels or tube in partition for support as shown, and extend full height from floor to underside of structural slab above.
2. Anchor at top and bottom with angle clips bolted to channels or tube with two, 9 mm (3/8 inch) diameter bolts.
3. Anchor to floors and overhead construction with two 9 mm (3/8 inch) diameter bolts.
4. Fasten clips to concrete with expansion bolts, and to steel with machine bolts or welds.

H. Supports for Trapeze Bars:
1. Secure plates to overhead construction with fasteners as shown.
2. Secure angle brace assembly to overhead construction with fasteners as shown and bolt plate to braces.
3. Fit modular channel unit flush with finish ceiling, and secure to plate with modular channel unit manufacturer's standard fittings through steel shims or spreaders as shown.
   a. Install closure plates in channel between eye bolts.
   b. Install eyebolts in channel.

I. Support for Communion Rail Posts:
1. Anchor steel plate supports for posts as shown.
2. Use four bolts per plate, locate two at top and two at bottom.
3. Use lag bolts.

3.3 COVERS AND FRAMES FOR PITS AND TRENCHES

A. Set frame and cover flush with finish floor.

B. Secure plates to frame with flat head countersunk screws.

C. Set gratings loose in drainage trenches or over pits unless shown anchored.

3.4 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.

3.5 DOOR FRAMES

A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.

B. Level and plumb frame; brace in position required.

C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.

D. Set frames in formwork for frames cast into concrete.

E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

3.6 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.

3.7 GUARDS

A. Steel Angle Corner Guards:

1. Build into masonry as the work progress.
2. Set into formwork before concrete is placed.
3. Set angles flush with edge of opening and finish floor or wall or as shown.
4. At existing construction fasten angle and filler piece to adjoining construction with 16 mm (5/8 inch) diameter by 75 mm (3 inch) long expansion bolts 450 mm (18 inches) on center.
5. Install Guard Angles at Edges of Openings in Slab Overhead Doors where shown.

B. Channel Guard at Top Edge of Concrete Platforms:

1. Install in formwork before concrete is placed.
2. Set channel flush with top of the platform.

C. Wheel Guards:

1. Set flanges of wheel guard at least 50 mm (2 inches) into pavement.
2. Anchor to walls as shown, expansion bolt if not shown.

3.8 GRATINGS

A. Set grating flush with finish floor; top of curb, or areaway wall. Set frame so that horizontal leg of angle frame is flush with face of wall except when frame is installed on face of wall.

B. Set frame in formwork before concrete is placed.

C. Where grating terminates at a wall bolt frame to concrete or masonry with expansion bolts unless shown otherwise.

D. Secure removable supporting members in place with stainless steel bolts.

E. Bolt gratings to supports.

3.9 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.

3.10 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.

3.11 PLATE DOOR SILL

A. Install after roofing base flashing and counter flashing work is completed.

B. Set in sealant and bolt to curb.

3.12 SAFETY NOSINGS

A. Except as specified and where preformed rubber treads are shown or specified install safety nosings at the following:

1. Exterior concrete steps.
2. Door sills of areaway entrances curbs.
3. Exposed edges of curbs of door sills at transformer and service rooms.
4. Interior concrete steps, including concrete filled treads of metal stairs of service stairs.

B. Install flush with horizontal and vertical surfaces.

C. Install nosing to within 100 mm (4 inches) of ends of concrete stair treads, except where shown to extend full width.
D. Extend nosings full width of door openings.
E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

3.13 LADDERS

A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.
B. In elevator pits, set ladders to clear all elevator equipment where shown on the drawings.
   1. Where ladders are interrupted by division beams, anchor ladders to beams by welding, and to floors with expansion bolts.
   2. Where ladders are adjacent to division beams, anchor ladders to beams with bent steel plates, and to floor with expansion bolts.
C. Ladder Rungs:
   1. Set ladder rungs into formwork before concrete is placed.
   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.

3.14 RAILINGS

A. Steel Posts:
   1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
   2. Install sleeves in concrete formwork.
   3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS—on exterior posts.
   4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
   5. Secure sliding flanged fittings to posts at base with set screws.
   6. Secure fixed flanged fittings to concrete with expansion bolts.
   7. Secure posts to steel with welds.
B. Aluminum Railing, Stainless Steel Railing, and Ornamental Railing Posts:

1. Install pipe sleeves in concrete formwork.
2. Set posts in sleeve and pour grout to surface on exterior locations and to within 6 mm (1/4 inch) of surface for interior locations except to where posts are required to be removable.
3. Apply beveled bead of urethane sealant over sleeve at post perimeter for exterior posts and flush with surface for interior posts as specified in Section 07 92 00, JOINT SEALANTS.

C. Anchor to Walls:
1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
   a. Anchor steel plate to concrete or solid masonry with expansion bolts.
   b. Anchor steel plate to hollow masonry with toggle bolts.
2. Anchor flanged fitting with toggle bolt to steel support in frame walls.

D. Removable Rails:
1. Rest rails in brackets at each end and secure to bracket with stainless steel bolts and nuts where part of a continuous railing.
2. Rest rail posts in sleeves where not part of a continuous railing. Do not grout posts.

E. Gates:
1. Hang gate to swing as shown.
2. Bolt gate hinges to jamb post with clamp on or through bolts.

F. Chains:
1. Eye bolt chains to pipe posts.
2. Eye bolt anchoring at walls.
   a. Expansion bolt to concrete or solid masonry.
   b. Toggle bolt to hollow masonry of frame wall installed support.

G. Handrails:
1. Anchor brackets for metal handrails as detailed.
2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
3. Expansion bolt to concrete or solid masonry.
4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

3.15 CATWALK AND PLATFORMS

A. Expansion bolt members to concrete unless shown otherwise.

B. Bolt or weld structural components together including ladders and stairs to support system.
C. Weld railings to structural framing.
D. Bolt or weld walk surface to structural framing.
E. Smooth field welds and spot prime damaged prime paint surface.
F. Fasten removable members with stainless steel fasteners.

3.16 SIDEWALK DOOR, TRAP DOORS, AND FRAMES

A. Set frame flush with finished concrete slab or curb.
B. Secure well linings to structure with expansion bolts unless shown otherwise.
C. Bolt ceiling hatch to well lining angle brace and to angle iron frames near corners and 300 mm (12 inches) on centers with not less than 9 mm (3/8 inch) roundhead machine screws.
D. Coordinate sidewalk door drain connections with plumbing work.

3.17 SCREENED ACCESS DOOR

A. Set frame in opening so that clearance at jambs is equal and secure with expansion bolts.
B. Use shims at bolts to prevent deformation of frame members in prepared openings.
C. Set frame in mortar bed and build in anchors as the masonry work progresses.
D. Grout jambs solid with mortar.
E. Secure insect screen to inside of door with stainless steel fasteners on doors in exterior walls.

3.18 STEEL COMPONENTS FOR MILLWORK ITEMS

Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

3.19 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.

- - - E N D - - -

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

1.2 SUMBITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect lumber and other products from dampness both during and after delivery at site.

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

C. Stack plywood and other board products so as to prevent warping.

D. Locate stacks on well drained areas, supported at least 150 mm (6 inches) above grade and cover with well ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.4 APPLICABLE PUBLICATIONS:

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

B. American Forest and Paper Association (AFPA):
National Design Specification for Wood Construction
NDS-05.....Conventional Wood Frame Construction

C. American Institute of Timber Construction (AITC):
A190.1-02.....Structural Glued Laminated Timber

D. American Society of Mechanical Engineers (ASME):
B18.2.1A-96(R2005).....Square and Hex Bolts and Screws
B18.2.2-87(R2005).....Square and Hex Nuts
B18.6.1-81 (R97).....Wood Screws
B18.6.4-98(R2005).....Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws

E. American Plywood Association (APA):
E30-03.....Engineered Wood Construction Guide

F. American Society for Testing And Materials (ASTM):

A47-99(R2004).....Ferritic Malleable Iron Castings

A48-03.....Gray Iron Castings

A653/A653M-07.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

C954-04.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (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 Metal Studs

D143-94(R2004).....Small Clear Specimens of Timber, Method of Testing

D1760-01.....Pressure Treatment of Timber Products

D2559-04.....Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions

D3498-03.....Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

F844-07.....Washers, Steel, Plan (Flat) Unhardened for General Use

F1667-05.....Nails, Spikes, and Staples

G. Federal Specifications (Fed. Spec.):

MM-L-736C.....Lumber; Hardwood

H. Commercial Item Description (CID):

A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)

I. Military Specification (Mil. Spec.):

MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

J. Truss Plate Institute (TPI):

TPI-85.....Metal Plate Connected Wood Trusses

K. U.S. Department of Commerce Product Standard (PS)

PS 1-95.....Construction and Industrial Plywood

PS 20-05.....American Softwood Lumber Standard

PART 2 - PRODUCTS

2.1 LUMBER:

A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.

1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Structural Members: Species and grade as listed in the AFPA, National Design Specification for Wood Construction having design stresses as shown.

C. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
2. Framing lumber: Southern Pine #2.

3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.

D. Sizes:

1. Conforming to Prod. Std., PS20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:

1. At time of delivery and maintained at the site.
2. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
3. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:

1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members used in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

2.2 PLYWOOD

A. Comply with Prod. Std., PS 1.

B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.

C. Sheathing:
   1. APA rated Exposure 1 or Exterior; panel grade CD or better.
   2. Wall sheathing:
      a. Minimum 9 mm (11/32 inch) thick with supports 400 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 600 mm (24 inches) on center unless specified otherwise.
      b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
   3. Roof sheathing:
      a. Minimum 9 mm (11/32 inch) thick with span rating 24/0 or 12 mm (15/32 inch) thick with span rating for supports 400 mm (16 inches) on center unless specified otherwise.
      b. Minimum 15 mm (19/32 inch) thick or span rating of 40/20 or 18 mm (23/32 inch) thick or span rating of 48/24 for supports 600 mm (24 inches) on center.

2.3 STRUCTURAL-USE PANELS

A. Comply with APA.

B. Bearing the mark of a recognized association or independent agency that maintains continuing control over quality of panel which identifies compliance by end use, Span Rating, and exposure durability classification.

C. Wall and Roof Sheathing:

1. APA Rated sheathing panels, durability classification of Exposure 1 or Exterior Span Rating of 16/0 or greater for supports 400 mm (16 inches) on center and 24/0 or greater for supports 600 mm (24 inches) on center.

D. Laminated Veneer Lumber (LVL):

1. Bonded jointed wood veneers with ASTM D2559 adhesive.
2. Scarf jointed wood veneers with grain of wood parallel.
3. Size as shown.

2.4 ROUGH HARDWARE AND ADHESIVES:

A. Anchor Bolts:

1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
2. Extend at least 200 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).

B. Miscellaneous Bolts: Expansion Bolts: C1D, A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Use 13 mm (1/2 inch) bolt unless shown otherwise.

C. Washers

1. ASTM F844.
2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.

D. Screws:

1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:

1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
2. ASTM F1667:
   a. Common: Type I, Style 10.
   b. Concrete: Type I, Style 11.
   c. Barbed: Type I, Style 26.
   d. Underlayment: Type I, Style 25.
   e. Masonry: Type I, Style 27.
   f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not

less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

F. Framing and Timber Connectors:

1. Fabricate of ASTM A446, Grade A; steel sheet not less than 1.3 mm (0.052 inch) thick unless specified otherwise. Apply standard plating to steel timber connectors after punching, forming and assembly of parts.
2. Framing Angles: Angle designed with bendable legs to provide three way anchors.
3. Straps:
   a. Designed to provide wind and seismic ties with sizes as shown or specified.
   b. Strap ties not less than 32 mm (1-1/4 inches) wide.
   c. Punched for fastener.
4. Metal Bridging:
   a. Optional to wood bridging.
   b. V shape deformed strap with not less than 2 nail holes at ends, designed to nail to top and side of framing member and bottom and side of opposite member.
   c. Not less than 19 mm by 125 mm (3/4 by 5 inches) bendable nailing flange on ends.
   d. Fabricated of 1 mm (0.04 inch) minimum thick sheet.
5. Joist Hangers:
   a. Fabricated of 1.6 mm (0.063 inch) minimum thick sheet, U design unless shown otherwise.
   b. Heavy duty hangers fabricated of minimum 2.7 mm (0.108 inch) thick sheet, U design with bent top flange to lap over beam.
6. Timber Connectors: Fabricated of steel to shapes shown.
7. Joist Ties: Mild steel flats, 5 by 32 mm (3/16 by 1-1/4 inch size with ends bent about 30 degrees from horizontal, and extending at least 400 mm (16 inches) onto framing. Punch each end for three spikes.
8. Wall Anchors for Joists and Rafters:
   a. Mild steel strap, 5 by 32 mm (3/16 by 1-1/4 inch) with wall ends bent 50 mm (2 inches), or provide 9 by 130 mm (3/8 by 5 inch) pin through strap end built into masonry.
   b. Strap long enough to extend onto three joists or rafters, and punched for spiking at each bearing.

c. Strap not less than 100 mm (4 inches) embedded end.

9. Joint Plates:

a. Steel plate punched for nails.

b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.

c. Size for axial eccentricity, and fastener loads.

G. Adhesives:

1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.

2. For structural laminated Wood: ASTM D2559.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:

1. AFPA National Design Specification for Wood Construction for timber connectors.

2. AITC Timber Construction Manual for heavy timber construction.

3. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.

4. APA for installation of plywood or structural use panels.

5. ASTM F 499 for wood underlayment.

6. TPI for metal plate connected wood trusses.

B. Fasteners:

1. Nails.

a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual for House Framing where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.

b. Use special nails with framing connectors.

c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.

d. Use eight penny or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.

e. Use 16 penny or larger nails for nailing through 50 mm (2 inch) thick lumber.

f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.

g. Nailing Schedule; Using Common Nails:

1) Joist bearing on sill or girder, toe nail three-8d or framing anchor
2) Bridging to joist, toe nail each end two-8d
3) Ledger strip to beam or girder three-16d under each joint.
4) Subflooring or Sheathing:
   a) 150 mm (6 inch) wide or less to each joist face nail two-8d.
   b) Subflooring, more than 150 mm (6 inches) wide, to each stud or joint, face nail three-8d.
   c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 150 mm (6 inches) on center and at intermediate supports 250 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 300 mm (12 inches) at supported edges and 500 mm (20 inches) o.c. at intermediate supports.
5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 400 mm (16 inches) on center.
6) Top plate to stud, end nail two-16d.
7) Stud to sole plate, toe nail or framing anchor. Four-8d
8) Doubled studs, face nail 16d at 600 mm (24 inches) on center.
9) Built-up corner studs 16d at 600 mm (24 inches) (24 inches) on center.
10) Doubled top plates, face nails 16d at 400 mm (16 inches) on center.
11) Top plates, laps, and intersections, face nail two-16d.
12) Continuous header, two pieces 16d at 400 mm (16 inches) on center along each edge.
13) Ceiling joists to plate, toenail three-8d or framing anchor.
14) Continuous header to stud, four 16d.
15) Ceiling joists, laps over partitions, face nail three-16d or framing anchor.
16) Ceiling joists, to parallel rafters, face nail three-16d.
17) Rafter to plate, toe nail three-8d. or framing anchor. Brace 25 mm (1 inch) thick board to each stud and plate, face nail three-8d.
18) Built-up girders and beams 20d at 800 mm (32 inches) on center along each edge.

2. Bolts:
   a. Fit bolt heads and nuts bearing on wood with washers.
   b. Countersink bolt heads flush with the surface of nailers.
   c. Embed in concrete and solid masonry or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
   d. Use toggle bolts to hollow masonry or sheet metal.
   e. Use bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 600 mm (24 inch) intervals between end bolts. Use clips to beam flanges.
3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
   a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
   b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
   a. Where shown or option to nails.
   b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
   c. Spaced same as nails.
7. Installation of Timber Connectors:
   a. Conform to applicable requirements of the NFPA National Design Specification for Wood Construction.
   b. Fit wood to connectors and drill holes for fasteners so wood is not split.

C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
   1. Space anchor bolts 1200 mm (4 feet) on centers between ends and within 150 mm (6 inches) of end. Stagger bolts from side to side on plates over 175 mm (7 inches) in width.
   2. Use shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
   3. Closely fit, and set to required lines.

D. Cut notch, or bore in accordance with NFPA Manual for House-Framing for passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.

E. Blocking Nailers, and Furring:
   1. Install furring, blocking, nailers, and grounds where shown.
   2. Use longest lengths practicable.
   3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
   4. Layers of Blocking or Plates:
      a. Stagger end joints between upper and lower pieces.
      b. Nail at ends and not over 600 mm (24 inches) between ends.
      c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.

F. Floor Framing:
   1. Set with crown edge up.
   2. Keep framing at least 50 mm (2 inches) away from chimneys.
   3. Bear on not less than 100 mm (4 inches) on concrete and masonry, and 38 mm (1-1/2 inches) on wood and metal unless shown otherwise.
   4. Support joist, trimmer joists, headers, and beams framing into carrying members at same relative levels on joist hangers unless shown otherwise.
   5. Lap and spike wood joists together at bearing, or butt end-to-end with scab ties at joint and spike to plates. Scab tie lengths not less than 200 mm (8 inches) lap on joist ends. Install wood I beam joists as shown.
   6. Frame openings with headers and trimmer joist. Double headers carrying more than two tail joists and trimmer joists supporting headers carrying more than one tail joist unless otherwise shown.
   7. Drive nails through headers into joists using two nails for 50 mm by 150 mm (2 inch by 6 inch); three nails for 50 mm by 200 mm (2 inch by 8 inch) and four nails for 50 mm by 250 mm (2 inch by 10 inch) and over in size.
   8. Install nearest joist to double headers and spike joist to both header members before trimmer joist is installed and secured together.
   9. Doubled joists under partitions parallel with floor joists.
   10. Where joists run perpendicular to masonry or concrete, anchor every third joist to masonry or concrete with one metal wall anchor.

Securely spike anchors with three nails to side of joist near its bottom.

11. Anchor joists running parallel with masonry or concrete walls to walls with steel flats spaced not over 1800 mm (6 feet) apart. Extend steel flats over at least three joists and into masonry 100 mm (4 inches) with ends turned 50 mm (2 inches); bolt to concrete. Set top of flats flush with top of joists, and securely nail steel flats to each joist.
12. Hook ties at steel framing over top flange of steel members.
13. Nonbearing partitions running parallel with ceiling joists, install solid 50 mm (2 inch) thick bridging same depth as ceiling joists cut to fit snug between joists for securing top plate of partitions. Securely spike bridging to joists. Space 1200 mm (4 feet) on center.

G. Bridging:

1. Use 25 mm by 75 mm (1 inch by 3 inch) lumber with ends beveled for slope. Option: Metal bridging may be used for wood bridging.
2. Install one row of bridging for joist spans over 2400 mm (8 feet), but less than 4800 mm (16 feet) long; install two rows for spans over 4800 mm (16 feet) long.
3. Install an extra row of bridging between trimmer and next two joists if header is more than 600 mm (2 feet) from end of trimmer or from regular row of bridging.
4. Secure with two nails at ends.
5. Leave bottom ends loose until after subflooring or roof sheathing is installed.
6. Install single row of bridging at centerline of span and two rows at the third points of span unless otherwise shown.

H. Roof Framing:

1. Set rafters with crown edge up.
2. Form a true plane at tops of rafters.
3. Valley, Ridge, and Hip Members:
   a. Size for depth of cut on rafters.
   b. Straight and true intersections of roof planes.
   c. Secure hip and valley rafters to wall plates by using framing connectors.
   d. Double valley rafters longer than the available lumber, with pieces lapped not less than 1200 mm (4 feet) and spiked together.
   e. Butt joint and scab hip rafters longer than the available lumber.

4. Spike to wall plate and to ceiling joists except when secured with framing connectors.
5. Frame openings in roof with headers and trimmer rafters. Double headers carrying more than one rafter unless shown otherwise.
6. Install 50 mm by 100 mm (2 inch by 4 inch) strut between roof rafters and ceiling joists at 1200 mm (4 feet) on center unless shown otherwise.

I. Partition and Wall Framing:

1. Use 50 mm by 100 mm (2 inch by 4 inch) studs spaced 400 mm (16 inches) on centers; unless shown otherwise.
2. Install double studs at openings and triple studs at corners.
3. Installation of sole plate:
   a. Anchor plates of walls or partitions resting on concrete floors in place with expansion bolts, one near ends of piece and at intermediate intervals of not more than 1200 mm (4 feet) or with power actuated drive pins with threaded ends of suitable type and size, spaced 600 mm (2 feet) on center unless shown otherwise.
   b. Nail plates to wood framing through subfloor as specified in nailing schedule.
4. Headers or Lintels:
   a. Make headers for openings of two pieces of 50 mm (2 inch) thick lumber of size shown with plywood filler to finish flush with face of studs or solid lumber of equivalent size.
   b. Support ends of headers on top of stud cut for height of opening. Spike cut stud to adjacent stud. Spike adjacent stud to header.
5. Use double top plates, with members lapped at least 610 mm (2-feet) spiked together.
6. Install intermediate cut studs over headers and under sills to maintain uniformity of stud spacing.
7. Use single sill plates at bottom of opening unless shown otherwise. Toe nail to end stud, face nail to intermediate studs.
8. Install 50 mm (2 inch) blocking for firestopping so that maximum dimension of any concealed space is not over 2400mm (8 feet) in accordance with NFPA Manual for House Framing.
9. Install corner bracing when plywood or structured use panel sheathing is not used.

a. Let corner bracing into exterior surfaces of studs at an angle of approximately 45 degrees, extended completely over walls plates, and secured at bearing with two nails.

b. Use 25 mm by 100 mm (1 inch by 4 inch) corner bracing.

J. Sheathing:

1. Use plywood or structural-use panels for sheathing.
2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
3. Set nails not less than 9 mm (3/8 inch) from edges.
4. Install 50 mm by 100 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.

- - - E N D - - -

SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies exterior and interior millwork.

B. Items specified.

- Wall Paneling
- Chair Rail
- Moldings
- Base
- Wood Bumpers

1.2 RELATED WORK

A. Fabricated Metal brackets, bench supports and countertop legs: Section 05 50 00, METAL FABRICATIONS.

B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.

C. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. Millwork items – Half full size scale for sections and details 1:50 (1/4-inch) for elevations and plans.
2. Show construction and installation.

C. Samples:

Plastic laminate finished plywood or particleboard, 150 mm by 300 mm (six by twelve inches).

D. Certificates:

1. Indicating preservative treatment and fire retardant treatment of materials meet the requirements specified.
2. Indicating moisture content of materials meet the requirements specified.

E. List of acceptable sealers for fire retardant and preservative treated materials.

F. Manufacturer's literature and data:

1. Finish hardware
2. Sinks with fittings
3. Electrical components

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.

B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by Resident Engineer. Store at a minimum temperature of 21^{0}C (70^{0}F) for not less than 10 days before installation.

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

1.5 APPLICABLE PUBLICATIONS

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

B. American Society of Testing and Materials (ASTM):

A36/A36M-05.....Structural Steel

A53-06.....Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless

A167-99 (R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B26/B26M-05.....Aluminum-Alloy Sand Castings

B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

E84-07.....Surface Burning Characteristics of Building Materials

F436-07.....Hardened Steel Washers

C. American Hardboard Association (AHA):

A135.4-04.....Basic Hardboard

D. Builders Hardware Manufacturers Association (BHMA):

A156.9-03.....Cabinet Hardware

A156.11-04.....Cabinet Locks

A156.16-02.....Auxiliary Hardware

E. Hardwood Plywood and Veneer Association (HPVA):

HP1-04.....Hardwood and Decorative Plywood

F. National Particleboard Association (NPA):

A208.1-99.....Wood Particleboard

G. American Society of Mechanical Engineers (ASME):

B18.2.1-96(R2005).....Square and Hex Bolts and Screws (Inch Series)

H. American Wood-Preservers' Association (AWPA):

AWPA C1-03.....All Timber Products – Preservative Treatment by Pressure Processes

I. Architectural Woodwork Institute (AWI):

AWI-99.....Architectural Woodwork Quality Standards and Quality Certification Program

J. National Electrical Manufacturers Association (NEMA):

LD 3-05.....High-Pressure Decorative Laminates
LD 3.1-95.....Application, Fabrication and Installation of High-Pressure Decorative Laminates

K. U.S. Department of Commerce, Product Standard (PS):
PS1-95.....Construction and Industrial Plywood
PS20-05.....American Softwood Lumber Standard

L. Military Specification (Mil. Spec):
MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

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

PART 2 - PRODUCTS

2.1 LUMBER

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

B. Sizes:
1. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.
2. Millwork, standing and running trim, and rails: Actual size as shown or specified.

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

D. Softwood: PS-20, exposed to view appearance grades:
1. Use C select or D select, vertical grain for transparent finish including stain transparent finish.
2. Use Prime for painted or opaque finish.

E. Use edge grain Wood members exposed to weather.

2.2 PLYWOOD

A. Softwood Plywood:
1. Prod. Std.

2. Grading and Marking:
   a. Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.
   b. The mark shall identify the plywood by species group or identification index, and shall show glue type, grade, and compliance with PS1.
3. Plywood, 13 mm (1/2 inch) and thicker; not less than five ply construction, except 32 mm (1-1/4 inch) thick plywood not less than seven ply.
4. Plastic Laminate Plywood Cores:
   a. Exterior Type, and species group.
   b. Veneer Grade: A-C.
5. Shelving Plywood:
   a. Interior Type, any species group.
   b. Veneer Grade: A-B or B-C.
6. Other: As specified for item.

B. Hardwood Plywood:
1. HPVA: HP.1
2. Species of face veneer shall be as shown or as specified in connection with each particular item.
3. Inside of Building:
   a. Use Type II (interior) A grade veneer for transparent finish.
   b. Use Type II (interior) Sound Grade veneer for paint finish.
4. On Outside of Building:
   a. Use Type I, (exterior) A Grade veneer for natural or stained and varnish finish.
   b. Use Type I, (exterior) Sound Grade veneer for paint finish.
5. Use plain sliced cherry unless specified otherwise.

2.3 PARTICLEBOARD

A. NPA A208.1
B. Plastic Laminate Particleboard Cores:
1. Use Type 1, Grade 1-M-3, or Type 2, Grade 2-M-2, unless otherwise specified.
2. Use Type 2, Grade 2-M-2, exterior bond, for tops with sinks.

C. General Use: Type 1, Grade 1-M-3 or Type 2, Grade 2-M-2.

2.4 PLASTIC LAMINATE

A. NEMA LD-3.
B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General Purpose, Type HGL.

C. Cabinet Interiors including Shelving: Both of following options to comply with NEMA, CLS as a minimum.
   1. Plastic laminate clad plywood or particle board.
   2. Resin impregnated decorative paper thermally fused to particle board.
D. Backing sheet on bottom of plastic laminate covered wood tops: Backer, Type HGP.
E. Post Forming Fabrication, Decorative Surfaces: Post forming, Type HGP.

2.5 ADHESIVE

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

2.6 STAINLESS STEEL

ASTM A167, Type 302 or 304.

2.7 ALUMINUM CAST

ASTM B26

2.8 ALUMINUM EXTRUDED

ASTM B221

2.9 HARDWARE

A. Rough Hardware:
   1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric-galvanizing process. Galvanized where specified.
   2. Use galvanized coating on ferrous metal for exterior work unless non-ferrous metals or stainless is used.
   3. Fasteners:
      a. Bolts with Nuts: FF-N-836.
      b. Expansion Bolts: A-A-1922A.
      c. Screws: Fed. Spec. FF-S-111.
B. Finish Hardware
   1. Cabinet Hardware: ANSI A156.9.
      a. Door/Drawer Pulls: B02011. Door in seismic zones: B03182.
      b. Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm 3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep.

c. Sliding Door Tracks: B07063.
d. Adjustable Shelf Standards: B4061 with shelf rest B04083.
e. Concealed Hinges: B1601, minimum 110 degree opening.
f. Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
g. Cabinet Door Catch: B0371 or B03172.
h. Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.

2. Cabinet Locks: ANSI A156.11.
   a. Drawers and Hinged Door: E07262.
   b. Sliding Door: E07162.
3. Auxiliary Hardware: ANSI A156.16.
   a. Shelf Bracket: B04041, japanned or enameled finish.
   b. Combination Garment rod and Shelf Support: B04051 japanned or enamel finish.
   c. Closet Bar: L03131 chrome finish of required length.
   d. Handrail Brackets: L03081 or L03101.
      1) Cast Aluminum, satin polished finish.
      2) Cast Malleable Iron, japanned or enamel finish.
4. Steel Channel Frame and Leg supports for Counter top. Fabricated under Section 05 50 00, METAL FABRICATIONS.
5. Pipe Bench Supports:
   a. Pipe: ASTM A53.
6. Fabricated Wall Bench Supports:
   a. Steel Angles: ASTM A36 steel with chrome finish, or ASTM A167, stainless steel with countersunk wood screws, holes at 64 mm (2-1/2 inches) on center on horizontal member.
   b. Use 38 mm by 38 mm by 5 mm (1-1/2 by 1-1/2 by 3/16 inch) angle thick drilled for screw and bolt holes unless shown otherwise. Drill 6 mm (1/4 inch) holes for anchors on vertical member, not more than 200 mm (8 inches) on center between ends or corners.
   c. Stainless steel bars brackets: ASTM A167, fabricated to shapes shown, Number 4 finish. Use 50 mm by 5 mm (2 inch by 3/16 inch) bars unless shown otherwise. Drill for anchors and screws. Drill countersunk wood screw holes at 64 mm (2-1/2 inches) on center on horizontal members and not less than two 13 mm (1/4 inch) hole for anchors on vertical member.
7. Foot operated drawer opener.
   a. By Hafele or equal.

8. Edge Strips Moldings:
   a. Driven type "T" shape with serrated retaining stem; vinyl plastic to match plastic laminate color, stainless steel, or 3 mm (1/8 inch) thick extruded aluminum.
   b. Stainless steel or extruded aluminum channels.
   c. Stainless steel, number 4 finish; aluminum, mechanical applied medium satin finish, clear anodized 0.1 mm (0.4 mils) thick.
9. Rubber or Vinyl molding
   a. Rubber or vinyl standard stock and in longest lengths practicable.
   b. Design for closures at joints with walls and adhesive anchorage.
   c. Adhesive as recommended by molding manufacturer.
10. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

2.10 MOISTURE CONTENT

A. Moisture content of lumber and millwork at time of delivery to site.
   1. Interior finish lumber, trim, and millwork 32 mm (1-1/4 inches) or less in nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
   2. Exterior treated or untreated finish lumber and trim 100 mm (4 inches) or less in nominal thickness: 15 percent.
   3. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

2.11 FIRE RETARDANT TREATMENT

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

2. Hardwood face and back veneers untreated,
3. Factory seal panel edges, to prevent loss of fire retardant salts.

2.12 PRESERVATIVE TREATMENT

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

B. Use Grade A, exterior plywood for treatment.

2.13 FABRICATION

A. General:
1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.
2. Finish woodwork shall be free from pitch pockets.
3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
4. Plywood shall be not less than 13 mm (1/2 inch), unless otherwise shown or specified.
5. Edges of members in contact with concrete or masonry shall have a square corner caulking rebate.
6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded a shown.
7. Interior trim and items of millwork to be painted may be fabricated from jointed, built-up, or laminated members, unless otherwise shown on drawings or specified.
8. Plastic Laminate Work:
   a. Factory glued to a plywood or core, thickness as shown or specified.
   b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.
   c. Provide plastic backing sheet on underside of countertops, vanity tops, including back splashes and end splashes of countertops.
   d. Use backing sheet on concealed large panel surface when decorative face does not occur.

B. Wall Paneling:
1. Fire Retardant Treated
2. Hardwood plywood
   a. Vertical V-grooved planked unless specified otherwise.
   b. Thickness: 19 mm (3/4 inch) unless shown otherwise.
   d. Use full height panels where possible without end joints.

3. Solid hardwood.
   a. White oak or red oak, number one common grade.
   b. Tongue and groove, including end matched.
   c. Thickness: Not less than 19 mm (3/4 inch).
   d. Random Lengths not less than 600 mm (24 inches), 57 mm (2-1/4 inches) wide.
4. Trim and base:
   a. Quarter round at ceiling and vertical edge.
   b. Two-member base as shown.
5. Use nominal one by 100 mm (4 inches) softwood furring strips.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Maintain work areas and storage areas to a minimum temperature of 21^{0}C (70^{0}F) for not less than 10 days before and during installation of interior millwork.

B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

3.2 INSTALLATION

A. General:
   1. Millwork receiving transparent finish shall be primed and back-painted on concealed surfaces. Set no millwork until primed and back-painted.
   2. Secure trim with fine finishing nails, screws, or glue as required.
   3. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.
   4. Seal cut edges of preservative and fire retardant treated wood materials with a certified acceptable sealer.
   5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
   6. Plumb and level items unless shown otherwise.
   7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
   8. Exterior Work: Joints shall be close fitted, metered, tongue and grooved, rebated, or lapped to exclude water and made up in thick white lead paste in oil.

B. Wall Paneling:
   1. Solid hardwood boards

a. Install 25 by 75 mm (1 by 3 inch) furring strips on 400 mm (16 inch) centers horizontally between top and bottom strips. Secure to each stud with two screws.
b. Install paneling laid vertically with end joints staggered between adjacent boards.
c. Tightly butt joints and blind nail each board at each furring strip.

2. Install edge trim and base as shown, use solid wood members of same species as wall paneling.
3. Plywood paneling:
   a. Install 25 by 75 mm (1 by 3 inch) furring strips horizontally, under end joints of plywood and 300 mm (16 inches) on center between end strips. Install cross furring strips centered vertically at side joints of plywood paneling less than 13 mm (1/2 inch) thick. Secure to each stud with two screws.
   b. Install panels with long edge vertically and end joints aligned where exposed to view.
   c. Align V-grooves where end joints meet and maintain continuity of pattern.
   d. Apply adhesive to each furring strip so that panel is bonded to furring strip in continuous bead of adhesive in accordance with adhesive manufacturers specifications.
   e. Nailing:
      1) Nail in V-grooves to horizontal furring strips and at panel edges and within 25 mm (1 inch) of ends except within 50 mm (2 inches) of end when panel end abutts other surfaces. Do not space nails in V-groves over 150 mm (6 inches), on center.
      2) Nail ungrooved panels at 400 mm (16 inches) centers to horizontal furring strips between end or edge nails. Set nails and fill hole with filler to match wood panel for panels thicker than 13 mm (1/2 inch). Set nails flush with surface of panel thinner than 13 mm (1/2 inch).
      3) Use colored nails matching panel finish for prefinished panels or panels less than 13 mm (1/2 inch) thick.

C. Install with butt joints in straight runs and miter at corners.

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SECTION 06 73 00
COMPOSITE DECKING AND RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior decking and railing work made from wood and polypropylene composite material.

1.2 RELATED SECTIONS

A. Division 06 Section “Rough Carpentry” for framing, blocking, and other carpentry work associated with composite railing.

1.3 REFERENCES

A. ASTM International (ASTM):

1. ASTM D 696 – Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer.
2. ASTM D 1413 – Test Method for Wood Preservatives by Laboratory Soil-Block Cultures.
3. ASTM D 1761 – Test Methods for Mechanical Fasteners in Wood.
4. ASTM D 2394 – Methods for Simulated Service Testing of Wood and Wood-Base Finish Flooring.
5. ASTM D 2565 – Practice for Xenon Arc Exposure of Plastics Intended for Outdoor Applications.
6. ASTM D 3273 – Standard Test Method for Resistance for Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
7. ASTM D 4060 – Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
8. ASTM D 4442 – Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Material.
9. ASTM D 4812 – Test Method for Unnotched Cantilever Beam Impact Resistance of Plastics.
10. ASTM D 6109 – Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber.
11. ASTM D 6111 – Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement.
12. ASTM D 6864 – Standard Specification for Color and Appearance Retention of Solid Colored Plastic Siding Products.

13. ASTM E 84 – Test Method for Surface Burning Characteristics of Building Materials.
14. ASTM E 228 – Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer.

B. American Wood Preservers' Association (AWPA):
1. AWPA E1 – Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites.

C. Underwriters Laboratories, Inc. (UL):
1. UL 723 – Test for Surface Burning Characteristics of Building Materials.

D. U.S. Green Building Council (USGBC):
1. LEED Green Building Rating System (LEED).

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide decking and railing components capable of meeting the following minimum design loads when installed in the configuration indicated:
1. Deck: Uniform Live Load: 125 lbf/sq. ft. (6 kN/sq. m).
2. Guard Top Rail Concentrated Load: 200 lbf (0.89 kN) applied at any point in any direction.
3. Guard Top Rail Uniform Load: 50 lbf/ft. (0.73 kN/m) applied in any direction.
4. Intermediate Rail and Baluster Concentrated Load: 50 lbf (0.22 kN) applied to 1 sq. ft. (0.093 sq. m) area.

1.5 SUBMITTALS

A. Product Data: Manufacturer's data sheets, installation instructions, and maintenance recommendations for composite railing materials.

B. Product Test Reports: Indicating compliance of products with requirements, from a qualified independent testing agency.

C. Samples:
1. 4 inches (102 mm) long for each size and type of composite railing component.
2. For each type of fastener and hanger.
3. Selection Samples: For each finish product specified, two complete sets of color chips depicting the manufacturer's full range of available colors and textures.
4. Verification Samples: For each product selected, two samples depicting the specified color and pattern.

D. Research/Evaluation Reports: For composite railing from model code organization acceptable to authorities having jurisdiction.

E. Warranty: Submit sample meeting warranty requirements of this Section.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years experience in manufacture of similar products.

B. Source Limitations: Obtain composite railing materials through one source from a single manufacturer.

C. Fire-Test-Response Characteristics per ASTM E 84 or UL Standard 723: Flame spread index: 100 or less; Smoke developed index: 450 or less.

D. Mockup: Build mockup to verify approved materials and demonstrate acceptable workmanship.

1. Do not proceed with work until mockup has been approved by the Architect and Project Engineer.

2. Approved mockups may be incorporated in finished work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather. Store on flat surface with adequate support. Provide for air circulation within and around stacks and under temporary coverings.

1.8 WARRANTY

A. Special Warranty: Manufacturer’s standard form indicating manufacturer’s intent to replace composite railing materials that fail within 25 years following Substantial Completion under normal conditions of use and exposure. Failures are defined to include the following:

1. Rot, decay, splitting, checking, splintering, or termite damage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Composite Lumber, General: Wood thermoplastic composite material, UV- and heat-stabilized, consisting of combination of wood fiber and polypropylene, extrusion-molded into sizes and shapes indicated, with the following physical characteristics:

1. Flexural Strength, ASTM D 6109: 4020 lbf/sq. in. (27.58 MPa), minimum.

2. Tensile Strength, ASTM D 7031: 2700 lbf/sq. in. (18.62 MPa),

minimum.

3. Modulus of Elasticity, ASTM D 6109: 700,000 lbf/sq. in. (5860 MPa), minimum.
4. Modulus of Rupture, ASTM D 6109: 4000 lbf/sq. in. (37.23 MPa), minimum.
5. Weatherability Affect on Modulus of Rupture, 2000 hours, ASTM D 2565: 16 percent reduction of baseline MOR.
6. Density: ASTM D 6111: 6.0 lb/cu.ft. (1.15 g/cu.c), mimimum.
7. Impact Resistance: ASTM D 4812: 1.4 ft-lbf/in. (0.747 J/cm) parallel to length, minimum.
8. Coefficient of Thermal Expansion, ASTM E 228: 1.5×10^{-5} in/in/deg. F (2.7×10^{-5} mm/mm/deg. C), maximum.
9. Water Absorption, ASTM D 4442: 0.560, maximum.
10. Screw Withdrawal, ASTM D 1761: 1416 lbf (6220 N), minimum.
11. Termite Resistance, AWPA E1: 9.8, minimum.
12. Fungal Resistance, ASTM D 1413: No decay.
13. Abrasion Resistance, ASTM D 4060: .06 g/1000 cycles.
14. Flame Spread Index, ASTM E 84: 100 or less (Class III).
15. Coefficient of Friction, ASTM D 2394: 0.65, minimum, dry.
16. Coefficient of Friction, ASTM D 2394: 0.75, minimum, wet.
17. Resistance to Mold Growth, ASTM D 3273: 10 rating (no mold growth).

2.2 DECKING

A. Composite Decking:

1. Nominal Size: 5/4”x6”.
2. Fastening: Face fastened.
3. Color and Texture: As selected by Architect and manufacturer’s full line.

2.3 RAILINGS

A. Railing System: Composite lumber components consisting of newel posts, rails, and balusters.

1. Color and Texture: As selected by Architect and manufacturer’s full line.
2. Newel Posts: Nominal 4 by 4.
   a. Post caps and skirts: As selected by Architect from manufacturer’s full line.
   b. Post anchors: Attach newel posts in manner identical to attachment method recommended by manufacturer and tested

to meet requirements of Performance Requirements Article.

1) Surface-mounting: Install posts using manufacturer's surface-mounted, concealed, anchor kit consisting of a screw-attached steel base plate with welded steel upright post accepting attachment of newel post.

2) Recessed-mounting: Install posts using corrosion-resistant 1/2-inch (12-mm) diameter carriage bolts with 5/8-inch (15.9-mm) diameter washers.

3. Railings: Solid profile as indicated.

4. Balusters: Solid profile as indicated.

2.4 ACCESSORIES

A. Fasteners: Trim head screws, stainless steel, non-magnetic, 304 alloy, sized according to manufacturer's recommendations.

B. Brackets, Flanges, and Fittings: Manufacturer's recommended stainless steel, non-magnetic, 304 alloy, bolts, nuts, washers, and screws.

2.5 FABRICATION

A. General: Fabricate railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes.

B. Provide inserts and other anchorage devices for connection railing systems to structure. Fabricate anchorage devices capable of withstanding loading imposed by railing systems. Coordinate anchorage devices with supporting structure.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation of composite decking and railings upon correction of unsatisfactory conditions.

3.2 INSTALLATION, GENERAL

A. Install composite decking and railings in accordance with manufacturer's recommended installation instructions, details, and requirements of authorities having jurisdiction.

B. Install composite decking and railings true to line and aligned with adjacent materials. Use secured concealed shims where necessary for alignment. Remove burrs and rough edges.

C. Provide 1/8″ gap between deck boards for control of drainage and

thermal movement. Allow recommended end-to-end gap based upon ambient temperature at time of installation.

3.3 POST AND RAILING INSTALLATION

A. Install posts and railings as indicated and as recommended by railing manufacturer. Set railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack. Provide anchorage devices and fasteners where necessary for securing railing to existing construction. Predrill holes for fasteners.

B. Newell Posts: Where required for access to post fasteners, install posts prior to installing railing. Do not notch posts. Secure posts to supports by through-bolting, using post fastening kit supplied by post manufacturer.

C. Railings, Prefabricated: Center pre-routed railings between posts to provide equal spacing between terminal balusters and posts. Install squash block under center of bottom rail at mid-span. Secure railings to posts with metal angle brackets and screws. Conceal angle bracket vertical leg with end of railing; mortise railing end to provide snug fit over bracket leg to post.

1. Balusters: Fit balusters to mortised railings prior to screwing railings in place.

D. Railings, Site Fabricated: Secure railings to posts with fasteners and connectors of size and type recommended by manufacturer. Install railings parallel to each other and to stair runs.

1. Balusters: Space balusters evenly and in accordance with requirements of authorities having jurisdiction. Fasten balusters to railings.

3.4 CLEANING

A. Clean surfaces as required, following procedures and employing cleaning materials as recommended by manufacturer.

3.5 PROTECTION

A. Protect installed products from damage by subsequent construction activities, until completion of Project.

B. Field repair of damaged product finishes is limited to surface scratch repairs only. Use manufacturer’s recommended field repair procedures. Replace products that have been structurally damaged by subsequent construction activities.

- - -END - - -

SECTION 07 22 00
ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Installation of roof and deck insulation on new construction ready to receive roofing or waterproof membrane.

B. Repairs and alteration work to existing roof insulation.

1.2 RELATED WORK

A. Wood blocking and edge strips: Section 06 10 00, ROUGH CARPENTRY.

B. Sheet metal components: Section 07 60 00, FLASHING AND SHEET METAL.

1.3 QUALITY CONTROL

A. Supervision of work by persons who are knowledgeable and experienced in roofing. See submittals for documentation of supervisor’s qualification.

B. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Asphalt materials, each type
2. Roofing cement, each type
3. Roof insulation, each type
4. Fastening requirements
5. Insulation span data for flutes of metal decks

C. Samples:

1. Roof insulation, each type
2. Nails and fasteners, each type

D. Certificates:

1. Indicating type, thickness and thermal conductance of insulation (average thickness for tapered insulation).
2. Indicating materials and method of application of insulation system on metal decks meet the requirements of Factory Mutual Research Corporation for Class 1 Insulated Steel Deck Roofs.

E. Laboratory Test Reports: Thermal values of insulation products.

F. Layout of tapered roof system showing units required.

G. Documentation of supervisors training and experience showing knowledge of roofing procedures.

1.5 DELIVERY, STORAGE AND MARKING

A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.

B. Keep materials dry, and store in dry, weathertight facilities or under canvas tarps. Use of polyethylene or plastic tarps to cover materials is not permitted. Store above ground or deck level on wood pallets. Cover ground under stored materials with plastic tarp.

1. Store rolled materials (felts, base sheets, paper) on end. Do not store materials on top of rolled material.
2. Store foam insulation away from areas where welding is being performed and where contact with open flames is possible.

C. Protect from damage from handling, weather and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

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

B. Federal Specifications (Fed. Spec.):

UU-B-790A.....Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

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

C208-08.....Cellulosic Fiber Insulating Board

C209-07.....Test Methods for Cellulosic Fiber Insulating Board

C552-07.....Cellular Glass Thermal Insulation

C726-05.....Mineral Fiber Roof Insulation Board

C728-05.....Perlite Thermal Insulation Board

C1289-08.....Faced Rigid Cellular Polyisocynurate Thermal Insulation Board

D41-05.....Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

D312-00(R2006).....Asphalt Used in Roofing

D2178-04.....Asphalt Glass Felt Used in Roofing and Waterproofing

D2822-05.....Asphalt Roof Cement

F1667-05.....Driven Fasteners: Nails, Spikes, and Staples

D. Factory Mutual Global (FM):

1-28.....Winds Loads to Roof Systems and Roof Deck Securement

P7825-05.....Approval Guide

E. National Roofing Contractors Association (NRCA):

The NRCA Roofing Manual 2009

F. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory (2009)

G. U.S. Department of Commerce (NBS):

PS 1-07.....Structural Plywood

H. National Particleboard Association (NPA):

A208.1-93.....Mat-Formed Wood Particleboard

1.7 QUALITY ASSURANCE:

Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E 84. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM P7825. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

PART 2 - PRODUCTS

2.1 ASPHALT MATERIALS

A. Primer: ASTM D41.

B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.

C. Glass (Felt): ASTM D2178, Type IV, heavy duty ply sheet.

D. Venting Asphalt Base Sheet: ASTM D3672, Type I or Type II.

E. Roof Cement: ASTM D2822, Type I or Type II, asbestos free; or, D4586, Type I or Type II.

2.2 INSULATION

A. Cellular Glass: ASTM C552, Type IV, roof board.

B. Mineral Fiberboard: ASTM C726.

C. Perlite Board: ASTM C728.

D. Isocyanurate Board: ASTM C1289, Type I, Class 2 or Type III.

E. Cellulosic Fiberboard: ASTM C208, Type II, Grade 1 for built-up roofs; Grade 2 for single-ply roofing.

F. Nail base insulating board:

1. Top surface not less than 10 mm (3/8 inch) thick plywood, waferboard or wood particleboard nail base surface.
   a. Plywood: NBS PS 1, Exposure 1.
   b. Particleboard: ANSI A208.1, Type 1 Grade 1-M-2 or Type 2, Grade 2-M-2.
2. Insulation: Isocyanurate or urethane conforming to material specifications.
3. Bottom surface faced with felt facers.

G. Tapered Roof Insulation System Segments:

1. Fabricate of mineral fiberboard, isocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections.
2. Cut to provide high and low points with crickets and slopes as shown.
3. Minimum thickness of tapered sections; 13 mm (1/2 inch), unless manufacturers allow taper to zero mm (inch).

2.3 MISCELLANEOUS

A. Building Paper (Sheathing Paper):

1. Fed. Spec. UU-B-790, Type I, Barrier paper, Grade D, Water - Vapor permeable, Style 1a, Uncreped, not reinforced; or, Style 1b, Uncreped, not reinforced, red rosin sized.
2. Weighing approximately 3 kg/10 m^2 (six pounds per 100 square feet).

B. Tapered Edge Strips:

1. Tapered 1:12 (one inch per foot), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
2. Cellulosic Fiberboard: ASTM C208.
3. Mineral Fiberboard: ASTM C726.
4. Perlite Board: ASTM C728.

2.4 FASTENERS

A. Staples and Nails: ASTM F1667. Type as designated for item anchored and for substrate.

B. Nails for securing base sheets, and first ply of vapor retarder, to wood nailers and deck:
   1. Type I, Style 20, zinc coated steel roofing nails with minimum head diameter of 10 mm (3/8 inch) through metal discs at least 25 mm (one inch) across; or,
   2. One piece nails with an integral flat cap at least 24 mm (15/16 inch) across.
C. Nails for securing building paper and dry felt edge strips to wood nailer and decks:
   1. Type I, Style 20, zinc coated steel roofing nails, 16 mm (5/8 inch) minimum head diameter.
   2. Type IV, staples, Style 3, flat top crown, zinc coated may be used.
D. Nails into plywood: Annular thread type of length to provide at least 19 mm (3/4 inch) penetration.
E. Nails for securing base sheet, building paper, or first ply of vapor retarder to structural wood fiber decks:
   1. Self-clinching type having an integral flat cap not less than 25 mm (one inch) across.
   2. Nails shall have a holding power of not less than 18 kg (40 pounds) per fastener.
F. Fasteners for securing insulation to steel decks:
   1. Conform to requirements of Factory Mutual Research Corporation for wind uplift.
   2. Self-drilling galvanized screws with 50 mm (two inch) diameter disk.
   3. Antibackout thread design.
   4. Have a pullout resistance of 14 kg (30 pounds) minimum.

2.5 RECOVERED MATERIALS

A. Comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Plastic rigid foams: Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Rock wool material	75 percent recovered material

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

PART 3 - EXECUTION

3.1 GENERAL

A. Do not apply roof insulation if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon.

B. Entire roof deck construction of any section of the building shall be completed before insulation system work is begun. Curbs, blocking, edge strips, and other components which insulation, roofing and base flashing is attached to shall be in place ready to receive insulation and roofing. Coordinate roof insulation operations with roofing and sheet metal work so that insulation is installed to permit continuous roofing operations.

C. Insulation system materials shall be dry and damage free when applied. Do not use broken insulation or insulation with damaged facings. Remove damaged insulation from the site immediately.

D. Dry out surfaces, including the flutes of metal deck, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials only to dry substrates.

E. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, fog, snow, ice) or frost is present in any amount in or on the materials when temperature is below 10 °C (50 °F). Do not apply materials to substrate having temperature of 10 °C (50 °F) or less.

F. Phased construction is not permitted. The complete installation of all flashing, insulation, and roofing shall be completed in the same day except for the area where temporary protection is required when work is stopped.

3.2 SURFACE PREPARATION

A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.

B. Remove projections that might damage materials.

3.3 SELECTION OF RIGID INSULATION

A. Insulation Type:

1. Use either cellular glass, mineral fiberboard, perlite board, phenolic board, isocyanurate board, or urethane board or a combination thereof.

2. Use not less than two layers of insulation unless specified otherwise.
3. Use either 25 mm (one inch) thick mineral fiberboard, cellular glass, or perlite board as first layer over steel decks. Do not use phenolic, isocyanurate, or urethane board type insulation directly on steel roof decks.
4. Use either 13 mm (1/2 inch) thick perlite board or mineral fiber board as a top layer over urethane board or isocyanurate board. Composite board is acceptable.
5. Use only cellular glass block for plaza or promenade decks.
6. Where tapered insulation is used, all insulation shall be factory tapered, except perlite board may be field tapered.
7. Use same insulation as existing for roof repair and alterations unless specified otherwise.

B. Insulation Thickness:
1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the thermal resistance "R" value of not less than 13 for uniform thickness (average thickness where tapered insulation is used).
2. The minimum thickness of insulation for metal decks shall not be less than recommended by the insulation manufacturer to span the rib opening (flute size) of the metal deck used.
3. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Government.
4. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (drains) shall be not less than 38 mm (1-1/2 inches).
5. Use not less than two layers of insulation when insulation is 25 mm (one inch) or more in thickness unless specified otherwise.

3.4 INSTALLATION OF INSULATION

A. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer. Bed insulation layers in Type III or IV asphalt firmly pressed into the hot

bitumen. Keep bitumen below surface of insulation to receive single ply rubber roofing.

B. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.

C. Cover all insulation installed on the same day by either:
   1. The roofing membrane as specified.
   2. Temporary protection as specified.

D. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.

E. Cut to fit tight against blocking or penetrations.

F. Over Vapor Retarder, or Concrete Deck: Lay insulation in hot bitumen as specified.

G. Over Nailable Decks:
   1. Over poured gypsum, precast gypsum plank, cement-wood fiber plank, wood plank, or plywood deck, install one ply of base sheet or venting base sheet as specified; or, apply two plies of felt.
   2. Lay first ply of felt down dry and mop second ply to first ply at laps. Nail both plies to deck as specified.
   3. Lay base sheet down dry with mineral surface down; lap and nail down as specified.
   4. Lay insulation in hot bitumen over membrane or base sheet as specified.

H. Steel Deck:
   1. Material and method of application of insulation systems used on metal decks shall meet the requirements of Underwriters laboratories for Class A or Factory Mutual Research Corporation for Class I Insulated Steel Roof Deck.
   2. Mechanically anchor first layer of insulation to steel deck to conform to FM Class 1-90, Insulated Steel Roof Deck.
   3. Locate the long dimension edge joints to have solid bearing on top of deck ribs; do not cantilever over deck rib openings or flutes.

- - - E N D - - -

SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

Formed sheet metal work for flashing and insulated expansion joint covers are specified in this section.

1.2 RELATED WORK

A. Sealant compound and installation: Section 07 92 00, JOINT SEALANTS.

B. Color of factory coated metal and anodized aluminum.

C. Integral flashing component of manufactured roof specialties and accessories or equipment: Section 07 72 00, ROOF ACCESSORIES, and Division 22, PLUMBING.

D. Paint materials and application: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

Flashings

Copings

Gravel Stop-Fascia

Gutter and Conductors

Expansion joints

Fascia-cant

C. Manufacturer's Literature and Data:

Two-piece counterflashing

Thru wall flashing

Expansion joint cover, each type

Nonreinforced, elastomeric sheeting

Copper clad stainless steel

Polyethylene coated copper

Bituminous coated copper

Copper covered paper

Fascia-cant

D. Certificates: Stating that aluminum has been given - specified finish thickness of anodizing. Coating formulators approvals as specified.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below for 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):

A167-99(R 2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A653/A653M-07.....Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process

B32-04.....Solder Metal

B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate

B370-03.....Copper Sheet and Strip for Building Construction

D173-03.....Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing

D412-06.....Vulcanized Rubber and Thermoplastic Elastomers-Tension

D1187-97 (R2002).....Asphalt Base Emulsions for Use as Protective Coatings for Metal

D1784-07.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D3656-07.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

D4586-07.....Asphalt Roof Cement, Asbestos Free

C. American National Standards Institute/Single Ply Roofing Institute (ANSI/SPRI):

ES-1-2003.....Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual (2003 Edition).

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

AMP 500-505-88.....Metal Finishes Manual

F. American Architectural Manufacturers Association (AAMA):

605-98.....Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions Panels

G. Federal Specification (Fed. Spec):
A-A-1925A.....Shield, Expansion; (Nail Anchors)
UU-B-790A.....Building Paper, Vegetable Fiber

H. International Building Code (IBC):
2007 Edition

PART 2 - PRODUCTS

2.1 MATERIALS

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.

B. Stainless Steel: ASTM A167, Type 302B, dead soft temper.

C. Copper ASTM B370, cold-rolled temper.

D. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m² (3 oz/sf). Bituminous coating shall weigh not less than 2 kg/m² (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Exposed fabric surface shall be crimped.

E. Copper Covered Paper: Fabricated of electro-deposit pure copper sheets ASTM B 370, bonded with special asphalt compound to both sides of creped, reinforced building paper, UU-B-790, Type I, style 5, or to a three ply sheet of asphalt impregnated creped paper. Grooves running along the width of sheet.

F. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m² (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.

G. Aluminum Sheet: ASTM B209, alloy 3003-H14. Except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14.

H. Galvanized Sheet: ASTM, A653.

I. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

J. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m^2(6 lbs/100 sf).

K. Bituminous Paint: ASTM D1187, Type I.

L. Fasteners:

1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
2. Nails:
   a. Minimum diameter for copper nails: 3 mm (0.109 inch).
   b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
   c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
   d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
3. Rivets: Not less than 3 mm (1/8 inch) diameter.
4. Expansion Shields: Fed Spec A-A-1925A.

M. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.

N. Insect Screening: ASTM D3656, 18 by 18 regular mesh.

O. Roof Cement: ASTM D4586.

2.2 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:

B. Concealed Locations (Built into Construction):

1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
2. Stainless steel: 0.25 mm (0.010 inch) thick.
3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.
4. Galvanized steel: 0.5 mm (0.021 inch) thick.

C. Exposed Locations:

1. Copper: 0.4 Kg (16 oz).
2. Stainless steel: 0.4 mm (0.015 inch).
3. Copper clad stainless steel: 0.4 mm (0.015 inch).

D. Thickness of aluminum or galvanized steel is specified with each item.

2.3 FABRICATION, GENERAL

A. Jointing:

1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
3. Joints shall conform to following requirements:
   a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
   b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
   c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
4. Flat and lap joints shall be made in direction of flow.
5. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
   a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
   b. Wire brush to produce a bright surface before soldering lead coated copper.
   c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
   d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).

4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:
1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:
1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 0.6 Kg (24 ounce) copper 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1 Kg (32 oz) copper 1.6 mm (0.0625 inch) thick aluminum.

E. Drips:
1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge

back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.

2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC 2003.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.

2.4 FINISH

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.

B. In accordance with NAAMM Metal Finishes Manual, unless otherwise specified.

C. Finish exposed metal surfaces as follows, unless specified otherwise:

1. Copper: Mill finish.
2. Stainless Steel: Finish No. 2B or 2D.
3. Aluminum:
   a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
   b. Colored Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 18 mm (0.7 mils) thick. Dyes will not be accepted.
   c. Fluorocarbon Finish: AAMA 605, high performance organic coating.
   d. Mill finish.
4. Steel and Galvanized Steel:
   a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.

b. Manufacturer's finish:
   1) Baked on prime coat over a phosphate coating.
   2) Baked-on prime and finish coat over a phosphate coating.
   3) Fluorocarbon Finish: AAMA 605, high performance organic coating.

2.5 THROUGH-WALL FLASHINGS

A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
   1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
   2. Fabricate so keying nests at overlaps.

B. For Masonry Work When Concealed Except for Drip:
   1. Either copper, stainless steel, or copper clad stainless steel.
   2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
   3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.

C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
   1. Use same metal and thickness as counter flashing.
   2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
   3. Form exposed portion as snap lock receiver for counter flashing upper edge.

D. Window Sill Flashing and Lintel Flashing:
   1. Use either copper, stainless steel, copper clad stainless steel plane flat sheet, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
   2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
   3. Turn up back edge as shown.
   4. Form exposed portion with drip as specified or receiver.

E. Door Sill Flashing:
   1. Where concealed, use either 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.

2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use either 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.6 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
   1. Use either copper, or stainless steel, thickness specified unless specified otherwise.
   2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
   3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
   4. Use either copper, or stainless steel at pipe flashings.
B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).
C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.
E. Pipe Flashing: (Other than engine exhaust or flue stack)
   1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
   2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
   3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
      a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
      b. Allow for loose fit around and into the pipe.
   4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
      a. Extend sleeve up not less than 300 mm (12 inch) above roofing.

b. Allow for loose fit around pipe.

2.7 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Either copper or stainless steel, unless specified otherwise.

B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:

1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
4. Manufactured assemblies may be used.
5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.

C. One-piece Counterflashing:

1. Back edge turned up and fabricate to lock into reglet in concrete.
2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).

D. Two-Piece Counterflashing:

1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:

1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.

3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Pipe Counterflashing:

1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
4. Use stainless steel bolt on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.8 GRAVEL STOPS

A. General:

1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
3. Fabricate roof flange not less than 100 mm (4 inches) wide.
4. Fabricate top edge to extend above roof not less than 25 mm (one inch) for embedded gravel aggregate and not less than 100 mm (4 inches) for loose laid ballast.
5. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:
   a. Fabricate of one-piece material of suitable width for fascia height of 250 mm (10 inch) maximum or counterflashing lap of not less than 100 mm (4 inch) over base flashing.
   b. Fabricate bottom edge of formed fascia to receive edge strip.
   c. When fascia bottom edge forms counter flashing over roofing lap roofing not less than 150 mm (6 inches).

B. Formed Flat Sheet Metal Gravel Stops and Fascia:

1. Fabricate as shown of 0.5 Kg (20 ounce) copper, 1.25 mm (0.050 inch) thick aluminum.
2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.
3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch) at top and bottom. Clip shall be of the same thickness as the fascia.
5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.

C. Formed (Corrugated Sheet) Sheet Metal Gravel Stops and Fascia:
1. Fabricate as shown of 0.5 Kg (16 ounce) copper 0.8 mm (0.032 inch) thick aluminum.
2. Sheets shall have 2 mm (1/16 inch) deep corrugations either transversely or diagonally rolled into the sheet. Crimped sheets are not acceptable.
3. Factory fabricate prepackaged system, complete with fastenings.
4. Provide concealed flashing splice plate at joints not less than 150 mm (6 inches) long and continuous edge strip at lower edge of fascia made from same metal.
5. Fabricate as two-piece fascia when fascia depth exceeds 175 mm (7 inches).

2.9 BITUMEN STOPS

A. Fabricate bitumen stops for bituminous roofing edges for use with formed sheet metal gravel stops, pipe penetrations, and other penetrations through roof deck without a curb.

B. Fabricate with 19 mm (3/4 inch) vertical legs and 75 mm (3 inch) horizontal legs.

C. When used with gravel stop or metal base flashing use same metal for bitumen stop in thickness specified for concealed locations.

2.10

2.10 REGLETS

A. Fabricate reglets of one of the following materials:
1. 0.4 Kg (16 ounce) copper.

2. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
3. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.
4. Plastic, ASTM D1784, Type II, not less than 2 mm (0.075 inch) thick.

B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.

C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.

D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.

E. Fabricate mitered corners, fittings, and special shapes as may be required by details.

F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each

ply 50 mm (2 inch) with the slope and nail with large headed copper nails.

7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:

a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches)and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.

13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).

B. Flashing at Veneer Walls:
1. Install near line of finish floors over shelf angles or where shown.
2. Turn up against sheathing.
3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
4. At concrete backing, extend flashing into reglet as specified.
5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.

C. Window Sill Flashing:
1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
2. Turn back edge up to terminate under window frame.
3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.

D. Door Sill Flashing:
1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

3.3 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.
   1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
   2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
   3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
   4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.

C. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

D. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:
   1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
   2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
   3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
   4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
   5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
   6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:

1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.
   a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
      1) Locate fasteners in masonry mortar joints.
      2) Use screws to sheet metal or wood.
   b. Fill joint at top with sealant.
4. Where flashing or hood is mounted on pipe.
   a. Secure with draw band tight against pipe.
   b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
   c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:
1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:
   a. Secure to face construction in accordance, with manufacturers instructions.
   b. Completely fill space at the top edge of receiver with sealant.
3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

E. When counter flashing is a component of other flashing install as shown.

3.5 REGLETS

A. Install reglets in a manner to provide a watertight installation.

B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.

C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:

1. Coordinate reglets for anchorage into concrete with formwork construction.
2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.6 GRAVEL STOPS

A. General:

1. Install gravel stops and fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).
2. Extend roof flange of gravel stop and splice plates not less than four inches out over roofing and nail or screw to wood nailers. Space fasteners on 75 mm (3 inch) centers in staggered pattern.
3. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.
4. Where ends of gravel stops and fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
5. Set flange in roof cement when installed over built-up roofing.
6. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2003.

B. Sheet metal gravel stops and fascia:

1. Install with end joints of splice plates sheets lapped three inches.
2. Hook the lower edge of fascia into a continuous edge strip.
3. Lock top section to bottom section for two piece fascia.

C. Corrugated sheet gravel stops and fascia:

1. Install 300 mm (12 inch) wide sheet flashing centered under joint. A combination bottom and cover plate, extending above and beneath the joint, may be used.
2. Hook lower edge of fascia into a continuous edge strip.

D. Scuppers:

1. Install scupper with flange behind gravel stops; leave 6 mm (1/4 inch) joint to gravel stop.
2. Set scupper at roof water line and fasten to wood blocking.
3. Use sealant to seal joint with fascia gravel stops at ends.
4. Coordinate to lap over conductor head and to discharge water into conductor head.

3.7 COPINGS

A. General:

1. On walls topped with a wood plank, install a continuous edge strip on the front and rear edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.

B. Aluminum Coping:
1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
2. Install joint covers, centered at each joint, and securely lock in place.

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SECTION 07 61 00
PRE-FORMED STANDING SEAM METAL ROOFING

PART 1 - GENERAL:

1.1 DESCRIPTION:

A. Furnish all labor, materials, tools, equipment and perform all work and services necessary for, or incidental to, the furnishing and installation of the complete pre-formed standing seam metal roofing system as indicated on drawings and as specified herein.

B. The work as shown on the drawings will include but not be limited to:

1. Preformed metal roofing.
2. Flashing, trim and vent.

1.2 STRUCTURAL DESIGN AND REQUIRED PERFORMANCE TESTS:

A. UL 580 Wind Uplift Classification: The panel system shall be listed as a Class 90 windstorm rated system, as determined by UL580.

B. Air Infiltration: Air leakage through assembly of not more than 0.0011 when tested according to ASTM E 1680 at the following test pressure difference:

1. Test-Pressure Difference: 5 gallons/hour per square foot and static pressure of 20 PSF for 15 minutes.

C. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:

1. Test-Pressure of 20 PSF for 15 minutes

D. Dynamic Pressure Water Penetration: The panel system shall be tested in accordance with AAMA 501.1 and meet or exceed the following performance criteria:

1. No leakage at 70 mph wind velocity for 5 minutes.

E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

F. Panel Replaceability: Panel design shall be symmetrical with mechanically crimped batten cap to facilitate panel replacement.

G. Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads based on applicable code requirements.

H. Deflection limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than 1/180 of the span.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): +/- 220 degrees F
2. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction. Panel and seam cap configuration shall provide for the complete isolation of the sealant beads from the panel clip to prevent degradation of sealant from thermal movement cycles.

J. In addition to the above performance requirements, the roofing system must also be designed to meet ANSI A58.1-1982.

1.3 SUBMITTALS:

Shop Drawings: Submit engineered, sealed, shop drawings for approval. Show, locate and identify on 1/4" scale plans each component of panel system, accessories, anchors, connectors, clips, screws, and attachment to building construction. Show size of attachment devices and spacings of anchors, connectors, clips and screws. Show accurate architectural plans, elevations and sections indicating support and anchorage.

1. Submit engineer’s calculations to the Architect for review.

B. Engineering Calculations: Submit negative wind uplift pressure calculations. Calculations shall be sealed by a professional engineer licensed to practice structural engineering in the jurisdiction in which the project is located.

C. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.

D. Warranties: Samples of special warranties.

E. Samples:

1. Submit two samples 12" square of each exposed finish material and all roof fastening accessories.

F. Certification:

1. The preformed metal roofing manufacturer/supplier shall copy on his letterhead stationary, the following certification and shall have it signed and sealed by an engineer. Copies of this certification bearing original signatures shall be furnished to the Owner, Contractor and Architect and shall state the following:
2. The undersigned hereby certify and guarantee that the preformed metal roofing system supplied on the captioned project complies with the following:
   a) The minimum building design loads are as follows:
   b) Comply with the requirements of the loading indicated on the Documents however in no case shall it be no less than the requirement’s of the state building code.
   c) The metal roof panel system meets Underwriters' Laboratories Class 90 uplift classification and tested in accordance with ASTM E-1592.
3. The above guarantee and certification is separate from the General Contractor's responsibilities and warranty period.

1.4 QUALITY ASSURANCE

A. Roof panel manufacturer shall provide, at no additional cost to the owner, one day per week inspections. These inspections shall include a written report from the panel manufacturer. Inspections shall be conducted by a salaried employee of the roof panel manufacturer. Inspector shall be registered with the project architect prior to project commencement. Inspections conducted by roofing system distributors / dealers, or third parties will not be acceptable. The field inspector reserves the right to review and report to the project architect the level of acceptability of work completed and to subsequently issue a report of items not acceptable—if required.

B. Contractor with minimum 5 years in business, qualified by having performed similar work and having experienced workmen to perform work of type required by Contract Documents, and licensed where appropriate.

C. Source Limitations: Obtain each type of metal roof panels and underlayment from single source from single manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

B. Store materials off ground providing for drainage; under cover providing for air circulation; and protected from wind movement, foreign material contamination, mechanical damage, cement, lime or other corrosive substances.

C. Handle materials to prevent damage to surfaces, edges and ends of roofing sheets and sheet metal items. Damaged material shall be rejected and removed from the site.

D. Protect panels from wind-related damages.

1.6 JOB CONDITIONS:

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for preformed metal roofing system.

B. Protection:

1. Provide protection or avoid traffic on completed roof surfaces. Do not overload roof with stored materials. Support no roof-mounted equipment directly on roofing system.
2. Ascertain that work of other trades which penetrates the roof or is to be made watertight by the roof is in place and approved prior to installation of roofing.

1.7 WARRANTIES:

A. Endorse and forward to owner the following warranties:

1. Manufacturer's standard 25-year “No Dollar Limit” weather tightness warranty. The warranty coverage shall include all flashings, penetrations, underlayment, field applied gutter liner material and edge details as part of the weather tightness warranty. The warranty shall not limit wind requirements except those limited by ASCE 7-05 calculations and AAMA 501.1 testing along with other performance tests dictated in this specification. Design wind speed shall be specifically listed in the manufacturer’s warranty.
2. Manufacturer’s standard 25-year finish warranty. Deterioration includes, but is not limited to, the following:
   a) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c) Cracking, checking, peeling, or failure of paint to adhere to bare metal.

PART 2 - PRODUCTS:

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with specifications, provide products from one of the following:

1. Centria - “SR-3".
2. Imetco - "Snap-Lock". IMETCO ‘Series 300’
3. Merchant and Evans - "Zip-Rib".
4. Architect approved equivalent.

2.2 MATERIALS:

A. Sheet Steel:

1. Panel Material: Zinc Coated (Galvanized) Steel Sheet. Zinc-coated (galvanized) steel sheet Material: 22 gauge, G90 galvanized steel, per ASTM A653

B. Standing Seam Width:

1. ±16 or 18 – as required to meet negative uplift pressures

C. Finish:

1. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

D. Color:

1. Shall be selected by Architect from manufacturer’s full color palette.

2.3 ACCESSORIES:

A. Trim:

1. All trim details shall be accomplished as shown on the Architect's drawings. Trim shall be of same gauge, metal, color and finish as the roofing panels.

B. Vent Pipe Flashing:

1. Provide and install vent pipe flashings as required for a complete roofing system and approved by the Architect.

2.4 FABRICATION:

A. Shop fabricate metal roofing and flashing components to the maximum extent possible, forming metal work with clear, sharp, straight, and uniform bends and rises. Hem exposed edges of flashings.

B. Form flashing components from full single width sheet. Provide shop fabricated, mitered corners, joined using closed end pop rivets and joint sealant.

C. Fabricate roofing and related sheet metal work in accord with approved shop drawings and applicable standards.

Part 3 - EXECUTION:

3.1 GENERAL:

D. Inspection:

1. Examine alignment of structural steel and related supports prior to installation and do not proceed until defects are corrected.

E. Fasteners:

1. Roofing shall be installed with concealed fasteners in accordance with the manufacturer's recommendations and as necessary to withstand the designed loads indicated. The concealed fastening devices shall be designed to allow two directional movements of the roof sheets.

F. Roof Penetrations:

1. Shall be centered on rib. Coordinate with mechanical trade.

3.2 INSTALLATION:

A. All starter and edge flashings should be installed prior to panels.

B. Install metal roofing, trim and related items in conformance with approved shop drawings and manufacturer's specifications.

C Workmanship shall conform to standards set forth in the architectural sheet metal manual as published by SMACNA.

D. Roof sheets shall be full unbroken length from ridge to bottom of fascia.

E. Panels should be installed in such a manner that, horizontal lines are true and level, and vertical lines are plumb.

F. Do not allow panels or trim to come into contact with dissimilar materials.

G. On metal roofing and flashing, rigidly secure one end and allow other end to move with expansion and contraction. On slopes, secure the high end.

H. No oil canning effect shall be accepted.

I. The final appearance of the roof is square and straight, free of dents, dips and imperfections. If, in the opinion of the Architect, the final appearance of the roof work is not as neat, straight and level, it shall be demolished and reconstructed at the Contractor's expense until satisfactory to the Architect.

3.3 TOLERANCES:

G. Erection Tolerances:

1. Maximum variation from true planes or lines:

a) 1/4" in 20'-0"

3.4 CLEANING:

H. After installation, all pre-finish panels and metal shall be wiped clean and inspected for scratches or abrasions.

I. Touch up painting of minor damage to finishes shall be allowed (only upon written permission from the Architect), although damage to the finishes in the Architect's opinion as penetrating the protective surface, damaging the weather tightness or damage to the point where repair is obviously unsightly, shall be considered as not repairable and shall be replaced. Touch-up paint shall be furnished from the manufacturer, labeled and of the same dye lot.

J. All surfaces shall be of the same color and tone of color. Mismatched items shall be replaced.

- - - END - - -

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies copings, gravel stops, fascias, and expansion joints.

1.2 RELATED WORK

A. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.

B. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION

1.3 QUALITY CONTROL

A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.

B. Each accessory type shall be the same and be made by the same manufacturer.

C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples: Representative sample panel of color anodized aluminum not less than 100 mm X 100 mm (four by four inches), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.

C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.

D. Manufacturer's Literature and Data: Each item specified.

E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.5 APPLICABLE PUBLICATIONS

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

B. American Society for Testing and Material (ASTM):

B209/209M-07.....Aluminum and Aluminum Alloy-Sheet and Plate

B221/221M-07.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

C612-04.....Mineral Fiber Block and Board Thermal Insulation

D1187-97 (R2002).....Asphalt-Base Emulsions for Use as Protective Coatings for Metal

C. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-505-88.....Metal Finishes Manual

D. American Architectural Manufacturers Association (AAMA):
605-98.....High Performance Organic Coatings on Architectural Extrusions and Panels.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221/B221M.

B. Aluminum Sheet: ASTM B209/B209M.

C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.

D. Insulation: ASTM C612, Class 1 or 2.

~~E~~. Asphalt Coating: ASTM D 1187, Type I, quick setting.

2.2 COPINGS

A. Fabricate of aluminum not less than 2 mm (0.08 inch thick.

B. Turn outer edges down each face of wall as shown.

C. Maximum lengths of 3000 mm (10 feet).

D. Shop fabricate external and internal corners as one piece assemblies with not less than 300 mm (12 inch) leg lengths.

E. Provide 100 mm (four inch) wide 0.8 mm (0.032 inch) thick watertight joint covers.

F. Provide anchor gutter bar of 0.8 mm (0.032 inch) thick with anchor holes formed for underside of joint.

G. Provide concealed guttered splice plate of 0.8 mm (0.032 inch) thick with butyl or other resilient seal strips anchored to splice plate for underside of joint. Use galvanized steel anchor plate providing compression spring anchoring of coping cover.

H. Finish: Fluorocarbon as specified.

2.3 EXTRUDED ALUMINUM GRAVEL STOPS AND FASCIAS

A. Fabricate of aluminum not less than 2 mm (0.078 inch) thick.

B. Turn fascia down face of wall and up above roof as shown.

C. Maximum lengths of 3000 mm (10-feet).

D. Shop fabricate external and internal corners as one piece assemblies with not less than 300 mm (12 inch) leg lengths.

E. Provide 100 mm (four inch) wide 2 mm (0.078 inch) thick watertight joint covers with 150 mm (six inch) wide 0.8 mm (0.030 inch) thick underside joint flashing.

2.4 EXTRUDED ALUMINUM FASCIA-CANT SYSTEM

A. The fascia-cant system consists of three pieces, an extruded aluminum fascia, a galvanized steel cant, and an aluminum compression clamp.

B. Furnish in stock lengths of not more than 3000 mm (10 feet) long.

C. Form fascia from not less than 2 mm (0.070 inch) thick aluminum. Provide four inch wide 0.8 mm (0.032-inch) thick concealed sheet aluminum joint cover plates in back of fascia.

D. Form cant strip from galvanized steel not less than 0.8 mm (0.0299 inch) thick, to profile shown and design to hold lower edge of the fascia.

E. Form compression clamp of not less than 0.8 mm (0.032 inch) thick aluminum designed to hold the top edge of the fascia and the built-up flashing.

F. Internal and external corners:

1. Factory fabricate and fully weld mitered joints.
2. Furnish corner sections with not less than 300 mm (12 inch) leg lengths.

G. Factory fabricated scupper assemblies:

1. Fabricate scupper assembly with extended plates to match fascia-cant in 500 mm (20 inch) minimum lengths.
2. Extend outlet opening not less than 50 mm (two inches) with drip edge.
3. Fabricate with stainless steel cores or sleeve to drain water from toe of cant and flash in to built-up roofing with 100 mm (4 inch) wide flange.

I. Finish on aluminum: fluorocarbon.

2.5 FINISH

A. Fluorocarbon Finish: AAMA 605.2 high performance organic coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof accessories where shown.

B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.

C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.

D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.

E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.

F. Gravel Stops and Fascias:

1. Install gravel stops and fascia with butt joints with approximately 6 mm (1/4 inch) space for expansion.
2. Over each joint provide cover plates of sheet aluminum, complete with concealed sheet aluminum flashing, centered under each joint.
3. Lap cover plates and concealed flashing over the gravel stop and fascia not less than four inches.
4. Extend concealed flashing over built-up roofing, embed in roof cement and turn down over face of blocking at roof edge.

G. Aluminum Coping:
1. Install sections of coping with approximately 6 mm (1/4-inch) space between ends of sections.
2. Center joint gutter bar and covers at joints and securely lock in place.
3. When snap-on system is used insure front and back edges are locked in place.

H. Fascia-Cant System:
1. Install galvanized steel cant; coordinate with roofing work and after completion of roofing work install extruded aluminum fascia, concealed joint cover plate, and aluminum compression clamp, where shown.
2. Install system to allow for expansion and contraction with 6 mm (1/4 inch) space between extruded aluminum members and galvanized steel cant as required by manufacturer of system.
3. Offset joints in extruded aluminum members from galvanized steel cant joints.

I. Expansion Joint Covers:
1. Install to terminate base flashing 200 mm (8 inches) above roof.
2. Install moisture seals to drain water to outlets that do not permit water to enter buildings construction.
3. Use stainless steel screws when exposed.
4. Three piece assembly:
   a. Install curb section with screws to wood blocking, allowing 6 mm (1/4 inch) at butt joints between sections with splice plate at joint.
   b. Install cant to wood blocking by nailing along horizontal flange every 150 mm (6 inches), with galvanized roofing nails 25 mm (one inch) long.
   c. After completion of base flashing install cap flashing and compression clamp and fasten to the curb or metal cant with stainless steel self-tapping screws with neoprene washers under head spaced approximately 450 mm (18 inches) on center.

d. Install expansion joint cover with a 6 mm (1/4 inch) wide end joints.
e. Install over end joint a cover plate complete with concealed aluminum flashing, centered under each joint. Fabricate flashing to lap cover not less than four inches.

5. Two piece assembly:
   a. Install curb section with screws allowing 6 mm (1/4 inch) space at end joints with splice plate at joint.
   b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
   c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
   d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).

3.2 PROTECTION OF ALUMINUM

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.

B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING

Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

3.4 PROTECTION

Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.1 DESCRIPTION

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

B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

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

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.

C. List of FM, UL, or WH classification number of systems installed.

D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

1.4 DELIVERY AND STORAGE

A. Deliver materials in their original unopened containers with manufacturer’s name and product identification.

B. Store in a location providing protection from damage and exposure to the elements.

1.5 WARRANTY

Firestopping work subject to the terms of the Article “Warranty of Construction”, FAR clause 52.246-21, except extend the warranty period to five years.

1.6 QUALITY ASSURANCE

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):

E84-07.....Surface Burning Characteristics of Building Materials

E814-06.....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
1479-03.....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^2 (16 sq. in.) in overall cross sectional area.

C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.

D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
   1. Contain no flammable or toxic solvents.
   2. Have no dangerous or flammable out gassing during the drying or curing of products.
   3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
   4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:

1. Classified for use with the particular type of penetrating material used.
2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.

F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.

G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

H. Materials to be asbestos free.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.

B. Use mineral fiber filler and bond breaker behind sealant.

C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with 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.

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 Resident Engineer.

C. Clean up spills of liquid type materials.

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

A. Sealing of site work concrete paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

B. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.

D. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.

E. Section 22 05 00, COMMON WORK RESULTS FOR PLUMBING;

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 Resident Engineer 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. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.
F. 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 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's installation instructions for each product used.
C. Cured samples of exposed sealants for each color where required to match adjacent material.
D. Manufacturer's Literature and Data:
   1. Caulking compound
   2. Primers
   3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 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 (40° F) or less than 32° C (90° 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", FAR clause 52.246-21, except that warranty period shall be extended to two years.

B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS:

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

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

C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material.

C612-04.....Mineral Fiber Block and Board Thermal Insulation.

C717-07.....Standard Terminology of Building Seals and Sealants.

C834-05.....Latex Sealants.

C919-02.....Use of Sealants in Acoustical Applications.

C920-05.....Elastomeric Joint Sealants.

C1021-08.....Laboratories Engaged in Testing of Building Sealants.

C1193-05.....Standard Guide for Use of Joint Sealants.

C1330-02 (R2007).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

D1056-07.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.

E84-08.....Surface Burning Characteristics of Building Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).

The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS:

A. S-1:

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

B. S-2:

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

C. S-3:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.

3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-25.
6. Minimum elongation of 700 percent.

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

E. S-5:
1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade P.
5. Shore hardness of 15-45.

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

G. S-7:
1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

H. S-8:
1. ASTM C920, silicone, acetoxy cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

I. S-9:
   1. ASTM C920 silicone.
   2. Type S.
   3. Class 25.
   4. Grade NS.
   5. Shore A hardness of 25-30.
   6. Non-yellowing, mildew resistant.

J. S-10:
   1. ASTMC C920, coal tar extended fuel resistance polyurethane.
   2. Type M/S.
   3. Class 25.
   4. Grade P/NS.
   5. Shore A hardness of 15-20.

K. S-11:
   1. ASTM C920 polyurethane.
   2. Type M/S.
   3. Class 25.
   4. Grade P/NS.
   5. Shore A hardness of 35 to 50.

L. S-12:
   1. ASTM C920, polyurethane.
   2. Type M/S.
   3. Class 25, joint movement range of plus or minus 50 percent.
   4. Grade P/NS.
   5. Shore A hardness of 25 to 50.

2.2 CAULKING COMPOUND:

A. C-1: ASTM C834, acrylic latex.

B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

2.3 COLOR:

A. Sealants used with exposed masonry shall match color of mortar joints.

B. Sealants used with unpainted concrete shall match color of adjacent concrete.

C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.

D. Caulking shall be light gray or white, unless specified otherwise.

2.4 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

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

2.5 FILLER:

A. Mineral fiber board: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

2.7 CLEANERS-NON POUROUS SURFACES:

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 printed instructions.

1. Apply primer prior to installation of back-up rod or bond breaker tape.

2. Use brush or other approved means that will reach all parts of joints.

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

3.3 BACKING INSTALLATION:

A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.

D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

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

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

3.4 SEALANT DEPTHS AND GEOMETRY:

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

A. General:

1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool joints to concave surface unless shown or specified otherwise.
8. Finish paving or floor joints flush unless joint is otherwise detailed.

9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

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

C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
   1. Apply a 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. Threshold Setting Bed: Type S-1, S-3, S-4
5. Masonry Expansion and Control Joints: Type S-6
6. 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. Horizontal Traffic Joints:
   1. Concrete Paving, Unit Pavers: Type S-11 or S-12
E. High Temperature Joints over 204 degrees C (400 degrees F):
   1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8
F. Interior Caulking:
   1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2 and C-3.
   2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1, C-2 and C-3.
   3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1, C-2 and C-3.
   4. Perimeter of Lead Faced Control Windows and Plaster or Gypsum Wallboard Walls: Types C-1, C-2 and C-3.
   5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.
   6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
   7. Concealed Acoustic Sealant Type S-4, C-1, C-2 and C-3.

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SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section specifies floor, wall and ceiling seismic and building expansion joint assemblies.

B. Types of assemblies:
Metal Plate Cover
Elastomeric Joint Covers
Preformed Elastomeric Sealant Joint

1.2 RELATED WORK

A. Sheet Metal Expansion Joint Seals: Section 07 60 00, FLASHING AND SHEET METAL.

B. Roof Expansion Joint Cover Assemblies: Section 07 72 00, ROOF ACCESORIES.

C. Steel Plate Expansion Joint Covers: Section 05 50 00, METAL FABRICATIONS.

1.3 QUALITY ASSURANCE

A. Project Conditions:
1. Check actual locations of walls and other construction, to which work must fit, by accurate field measurements before fabrication.
2. Show recorded measurements on final shop drawings.

B. Fire tests performed by Factory Mutual, Underwriters Laboratories, Inc., Warnock Hersey or other approved independent testing laboratory.

1.4 DELIVERY STORAGE AND HANDLING

A. Take care in handling of materials so as not to injure finished surface and components.

B. Store materials under cover in a dry and clean location off the ground.

C. Remove materials which are damaged or otherwise not suitable for installation from job site and replace with acceptable materials.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
1. Submit copies of manufacturer's current literature and data for each item specified.

2. Clearly indicate movement capability of cover assemblies and suitability of material used in exterior seals for ultraviolet exposure.

C. Certificates: Material test reports from approved independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements specified.

D. Shop Drawings:

1. Showing full extent of expansion joint cover assemblies; include large-scale details indicating profiles of each type of expansion joint cover assembly, splice joints between sections, joiners with other type assemblies, special end conditions, anchorages, fasteners, and relationship to adjoining work and finishes.
2. Include description of materials and finishes and installation instructions.

E. Samples:

1. Samples of each type and color of metal finish on metal of same thickness and alloy used in work.
2. Samples of each type and color of flexible seal used in work.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed form part of this specification to extent referenced. Publications are referred to in text by basic designation only.

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

A36/A36M-05.....Structural Steel

A167-99 (R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A283/A283M-03.....Low and Intermediate Tensile Strength Carbon Steel Plates

A786/A786M-05.....Rolled Steel Floor Plates

B36/B36M-06.....Brass, Plate, Sheet, Strip, and Rolled Bar

B121-01(R2006).....Leaded Brass Plate, Sheet, Strip and Rolled Bar

B209M-06.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221M-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

B455-05.....Copper-Zinc Lead Alloy (Leaded Brass) Extruded Shapes

C864-05.....Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

C920-05.....Elastomeric Joint Sealants

D1187-97 (R2002).....Asphalt Base Emulsions for Use as Protective Coatings for Metal

D2287-96 (R2001).....Non-rigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

E119-07.....Fire Tests of Building Construction and Materials

E814-06.....Fire Tests of Through-Penetration Fire Stops

C. Federal Specifications (Fed. Spec):

TT-P-645B.....Primer, Paint, Zinc-Molybdate, Alkyd Type

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

AMP 500 Series.....Metal Finishes Manual.

E. National Fire Protection Association (NFPA):

251-05.....Tests of Fire Endurance of Building Construction and Materials

F. Underwriters Laboratories Inc. (UL):

263-03.....Fire Tests of Building Construction and Materials

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum:

1. Extruded: ASTM B221, alloy 6063-T5.
2. Plate and Sheet: ASTM B209, alloy 6061-T6.

B. Elastomeric Sealant:

1. ASTM C920, polyurethane.
2. Type.
3. Class 25.
4. Grade P or NS.
5. Shore A hardness 25, unless specified otherwise.

C. Thermoplastic Rubber:

1. ASTM C864.
2. Dense Neoprene or other material standard with expansion joint manufacturers having the same physical properties.

D. Accessories:

1. Manufacturer's standard anchors, fasteners, set screws, spaces, flexible secondary water stops or seals and filler materials, drain

tubes, adhesive and other accessories as indicated or required for complete installations.

2.2 FABRICATION

A. General:

1. Use ceiling and wall expansion joint cover assemblies of same design as floor to wall and floor to floor expansion joint cover assemblies. Unless shown otherwise.
2. Provide expansion joint cover assemblies of design, basic profile, materials and operation indicated required to accommodate joint size variations in adjacent surfaces, and as required for anticipated structural movement.
3. Deliver to job site ready for use and fabricated in as large sections and assemblies as practical. Assemblies identical to submitted and reviewed shop drawings, samples and certificates.
4. Furnish units in longest practicable lengths to minimize number of end joints. Provide mitered corners where joint changes directions or abuts other materials.
5. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections and other assemblies.
6. Seal Strip factory - formed and bonded to metal frames and anchor members.
7. Compression Seals: Prefabricate from thermoplastic rubber or dense neoprene to sizes and approximate profiles shown.

B. Interior Wall Joint Cover Assemblies:

1. Surface Mounted Metal Cover Plates:
   a. Concealed frame for fastening to wall on one sides of joint.
   b. Extend cover to lap each side of joint and to permit free movement on one side.
   c. Provide concealed attachment of cover t frame cover in close contact with adjacent finish wall surfaces.
   d. Use angle cover plates at intersection of walls.
   e. Use smooth surface cover plates matching floor plates.
   f. Use expansion fire inserts in fire rated walls, rated same as hour rating of wall.

C. Exterior Wall Joint Assemblies:

1. Variable movement with seal designed to prevent water and air infiltration.
2. Use vinyl seal strip as secondary seal behind primary seal.

3. Cover Plate Assemblies:
   a. Surface mounted cover plate.
   b. Concealed frame for fastening to wall on one side of joint.
   c. Extend cover to lap each side of joint and to permit free movement on one side.
   d. Provide concealed attachment of cover to frame for cover with cover in close contact with adjacent finish surfaces.
   e. Use angle cover plate of intersection of walls.
4. Extruded thermoplastic rubber joint assemblies.
   a. Aluminum frames both sides of joint.
      1) Designed to receive flexible rubber primary seal on exposed face after installation of frame.
      2) Designed to receive continuous secondary vinyl sheet seal.
      3) Anchor spaced at ends and not over 600 mm (24-inches).
   b. Variable movement extruded rubber primary seal designed to remain in aluminum frame, throughout movement of joint.
      1) Flush mounted seal minimum 3 mm (0.125-inch) thick with dual movement grooves designed for plus or minus 50 percent, movement of joint width.
      2) Seismic seal minimum 3 mm (0.125-inch) thick with multi-movement grooves designed for plus or minus 100 percent movement of joint width.
      3) Recessed front face seal minimum 3 mm (0.125-inch) thick with no movement grooves, designed for plus or minus 50 percent movement of joint width.
   c. Provide factory heat welded transitions where directional changes occur to ensure a watertight system.
   d. Provide pantographic wind load supports, maximum 2400 mm (8 feet) on center to support seal systems of 300 mm (12-inches) and wider.

D. Ceiling and Soffit Assemblies:
   1. Variable movement vinyl insert in metal frame on both sides of joint.
   2. Designed for flush mounting with no exposed fasteners.
   3. Vinyl insert locked into metal frame.
   4. Vinyl and metal finish as specified shall be selected by Archiect from manufacturer’s full palette.

5. Vinyl insert semi rigid either flush face or accordion shape as showed to span joint width without sagging.

E. Preformed Sealant Joint: Factory installed elastomeric sealant between extruded aluminum angle frame both sides.

1. Elastomeric Sealant: Two part polyurethane sealant with movement capability of +/- 25% of joint width per ASTM-C-920, Type M, Grade P, Class 25, Shore A hardness of 25+/-5.
2. Frame: Extruded Aluminum: Clear anodized.

2.3 METAL FINISHES

A. General:

1. Apply finishes in factory after products are fabricated.
2. Protect finishes on exposed surfaces with protective covering before shipment.

B. Aluminum Finishes:

1. Finish letters and numbers for anodized aluminum are in accordance with the NAAMM AMP 501, Aluminum Association's Designation System).
   a. Clear anodized finish: AA-C22A41 Chemically etched medium matte, clear anodic coating, Class I Architectural, 0.7 - mil thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Manufacturer’s representative shall make a thorough examination of surfaces receiving work of this section.

B. Before starting installation, notify prime contractor of defects which would affect satisfactory completion of work.

3.2 PREPARATION

A. Verify measurements and dimensions at job site and cooperate in coordination and scheduling of work with work of related trades.

B. Give particular attention to installation of items embedded in concrete and masonry so as not to delay job progress.

C. Provide templates to related trade for location of support and anchorage items.

3.3 INSTALLATION

A. Install in accordance with manufacturers installation instructions unless specified otherwise.

B. Provide anchorage devices and fasteners for securing expansion joint assemblies to in-place construction including threaded fasteners with drilled-in fasteners for masonry and concrete where anchoring members are not embedded in concrete. Provide metal fasteners of type and size

to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.

C. Perform cutting, drilling and fitting required for installation of expansion joint cover assemblies.

D. Install joint cover assemblies in true alignment and proper relationship to expansion joint opening and adjoining finished surfaces measured from established lines and levels.

E. Allow for thermal expansion and contraction of metal to avoid buckling.

F. Set floor covers at elevations flush with adjacent finished floor materials unless shown otherwise.

G. Material and method of grouting floor frames set in prepared recesses in accordance with manufacturer’s instructions.

H. Locate wall, ceiling and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories.

I. Locate anchors at interval recommended by manufacturer, but not less than 75 mm (3-inches) from each ends, and, not more than 600 mm (24-inches) on centers.

J. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.

K. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames or plates.

L. Flush Metal Cover Plates:
   1. Secure flexible filler between frames so that it will compress and expand.
   2. Adhere flexible filler materials to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

M. Waterstops:
   1. Install in conjunction with floor joints and where shown, run continuously to prevent water damage to finish spaces.
   2. Provide seal with frame to prevent water leakage.
   3. Provide outlet tubes from waterstops to drain to prevent damage to finish spaces.

N. Fire Barriers:
   1. Install in compliance with tested assembly.
   2. Install in floors and in fire rated walls.
   3. Use fire barrier sealant or caulk supplied with system.

O. Sealants:

Install to prevent water and air infiltration.

P. Vertical Exterior Extruded Thermoplastic Rubber.

1. Install side frames mounted on sealant or butyl caulk tape with appropriate anchors 600 mm (24 inches) on center complete with independent continuous PVC back seal.
2. Install primary seals retained in extruded aluminum side frames.

Q. Installation of Extruded Thermoplastic Rubber or Seals:

1. For straight sections, provide preformed seals in continuous lengths.
2. Vulcanize or heat-seal field splice joints to provide watertight joints using manufacturer's recommended procedures.

R. Installation of Preformed Elastomeric Sealant Joint:

1. Locate joint directly over joints in wall or floor substrates.
2. Full length shall be fastened to substrate using a construction adhesive.
3. Install flush or slightly below finish material.

3.4 PROTECTION

A. Take proper precautions to protect the expansion joint covers from damage after they are in place.

B. Cover floor joints with plywood where wheel traffic occurs.

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SECTION 09 29 00
GYPSUM BOARD

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, and ceilings: Section 05 40 00, COLD-FORMED METAL FRAMING

B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Cornerbead and edge trim.
2. Finishing materials.
3. Laminating adhesive.
4. Gypsum board, each type.

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 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):

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

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

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

C919-08.....Sealants in Acoustical Applications

C954-07.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness

C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

C1047-05.....Accessories for Gypsum Wallboard and Gypsum Veneer Base

C1177-06.....Glass Mat Gypsum Substrate for Use as Sheathing

C1658-06.....Glass Mat Gypsum Panels

C1396-06.....Gypsum Board

E84-08.....Surface Burning Characteristics of Building Materials

C. Underwriters Laboratories Inc. (UL):

Latest Edition.....Fire Resistance Directory

D. Inchcape Testing Services (ITS):

Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.

B. Coreboard or Shaft Wall Liner Panels.

1. ASTM C1396, Type X.
2. ASTM C1658: Glass Mat Gypsum Panels,

3. 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 C1396, Type X, 16 mm (5/8 inch) thick.

D. Gypsum cores shall contain a minimum of 95 percent post industrial recycled gypsum content. Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 GYPSUM SHEATHING BOARD

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

B. ASTM C1177, Type X.

2.3 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.

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. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:

1. Two sides of partitions:
   a. Fire rated partitions.
   b. Smoke partitions.
   c. Sound rated partitions.
   d. Full height partitions shown (FHP).
2. One side of partitions or furring:
   a. Inside of exterior wall furring or stud construction.

b. Room side of room without suspended ceilings.
c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.

3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.

B. In locations other than those specified, extend gypsum board from floor to heights as follows:
1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
2. At ceiling of suspended gypsum board ceilings.
3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

A. Coordinate installation of gypsum board with other trades and related work.

B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.

C. Moisture and Mold–Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.

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.
2. For two-ply assembles:
a. Use perpendicular application.
b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.

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. Installing Two Layer Assembly Over Sound Deadening Board:
   a. Apply face layer of wallboard vertically with joints staggered from joints in sound deadening board over framing members.
   b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.
9. 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. 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 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.

B. Conform to UL Design as listed on drawings.

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.
3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.

D. Gypsum Board:

1. Two hour wall:
   a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 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 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, fire rated and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier, fire rated, and sound rated construction. Sanding is not required of non- decorated surfaces.

3.6 REPAIRS

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

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction fire protection equivalent to the fire rated construction.

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SECTION 09 91 00
PAINTING

PART 1-GENERAL

1.1 DESCRIPTION

A. Section specifies field painting.

B. Section specifies prime coats which may be applied in shop under other sections.

C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

1.2 RELATED WORK

A. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS, Division 10 - SPECIALTIES, Division 11 - EQUIPMENT, Division 12 - FURNISHINGS, Division 13 – SPECIAL CONSTRUCTION, Division 14 – CONVEYING EQUIPMENT, Division 21 – FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 – HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 – ELECTRONIC SAFETY AND SECURITY sections.

B. Type of Finish, Color, and Gloss Level of Finish Coat: See interior finish specifications.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

C. Sample Panels:

1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
3. Panel to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 100 by 250 by 3 mm (4 inch by 10 inch

face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 by 50 mm (2 by 2 inch) minimum or actual wood member to show complete finish.

4. Attach labels to panel stating the following:
   a. Federal Specification Number or manufacturers name and product number of paints used.
   b. Specification code number specified in See finish documents.
   c. Product type and color.
   d. Name of project.
5. 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. High temperature aluminum paint.
   3. Epoxy coating.

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-2008.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)

ACGIH TLV-DOC-2008.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. American National Standards Institute (ANSI):

A13.1-07.....Scheme for the Identification of Piping Systems

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

D260-86.....Boiled Linseed Oil

E. Commercial Item Description (CID):

A-A-1555.....Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)

A-A-3120.....Paint, For Swimming Pools (RF) (cancelled)

F. Federal Specifications (Fed Spec):

TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

No. 5-07.....Exterior Alkyd Wood Primer

No. 8-07.....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)

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

No. 27-07.....Exterior / Interior Alkyd Floor Enamel, Gloss (FE)

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

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

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

No. 52-07.....Interior Latex, MPI Gloss Level 3 (LE)

No. 54-07.....Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)

No. 90-07.....Interior Wood Stain, Semi-Transparent (WS)

No. 91-07.....Wood Filler Paste

No. 94-07.....Exterior Alkyd, Semi-Gloss (EO)

No. 98-07.....High Build Epoxy Coating

No. 101-07.....Epoxy Anti-Corrosive Metal Primer

No. 114-07.....Interior Latex, Gloss (LE) and (LG)

H. Steel Structures Painting Council (SSPC):

SSPC SP 1-04 (R2004)....Solvent Cleaning

SSPC SP 2-04 (R2004)....Hand Tool Cleaning

SSPC SP 3-04 (R2004)....Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plastic Tape:

1. Pigmented vinyl plastic film in colors as specified.

2. Pressure sensitive adhesive back.
3. Widths as shown.

B. Identity markers options:
1. Pressure sensitive vinyl markers.
2. Snap-on coil plastic markers.

C. Exterior Alkyd Wood Primer: MPI 5.
D. Exterior Alkyd, Flat (EO): MPI 8.
E. Exterior Alkyd Enamel (EO): MPI 9.
F. Exterior/ interior Alkyd Floor Enamel, Gloss (FE): MPI 27.
G. Knot Sealer: MPI 36.
H. Interior Primer Sealer: MPI 45.
I. Interior Enamel Undercoat: MPI 46.
J. Interior Alkyd, Semi-Gloss (AK): MPI 47
K. Interior Latex Primer Sealer: MPI 50.
L. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.
M. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.
N. Interior Wood Stain, Semi-Transparent (WS): MPI 90.
O. Wood Filler Paste: MPI 91.
P. Exterior Alkyd, Semi-Gloss (EO): MPI 94.
Q. Fast Drying Metal Primer: MPI 95.
R. Epoxy Anti-Corrosive Metal Primer: MPI 101.
S. Interior latex, Gloss (LE) and (LG): MPI 114.

2.2 PAINT PROPERTIES

A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
2. Lead-Base Paint:
a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of

residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.

3. Asbestos: Materials shall not contain asbestos.
4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
6. Use high performance acrylic paints in place of alkyd paints, where possible.
7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
   1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
   2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.

B. Atmospheric and Surface Conditions:
   1. Do not apply coating when air or substrate conditions are:
      a. Less than 3 degrees C (5 degrees F) above dew point.
      b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
   2. Maintain interior temperatures until paint dries hard.
   3. Do no exterior painting when it is windy and dusty or raining.
   4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
   5. Apply only on clean, dry and frost free surfaces except as follows:
      a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
      b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.
   6. Varnishing:

a. Apply in clean areas and in still air.
b. Before varnishing vacuum and dust area.
c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 SURFACE PREPARATION

A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.

B. General:

1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
3. See other sections of specifications for specified surface conditions and prime coat.
4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.

C. Wood:

1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
   b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.
   b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

D. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
   a. This includes flat head countersunk screws used for permanent anchors.
   b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

E. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:

1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Remove loose mortar in masonry work.
4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 13 MASONRY MORTARING and Section 04 05 16 MASONRY GROUTING. Do not fill weep holes. Finish is to match adjacent surfaces.
5. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three days and brush thoroughly free of crystals.
6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

F. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 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 applications of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.
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 Resident Engineer, 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 except for exterior exposed steel apply an additional prime coat.

D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.

E. Wood and Wood Particleboard:

1. Use same kind of primer specified for exposed face surface.
   a. Exterior wood: MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer except where MPI 90 (Interior Wood Stain, Semi-Transparent (WS)) is scheduled.
   b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
   c. Transparent finishes as specified under Transparent Finishes on Wood except Floors.
2. Apply two coats of sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.

F. Metals except boilers, incinerator stacks, and engine exhaust pipes:

1. Steel and iron: MPI 95 (Fast Drying Metal Primer) finish is specified.

G. Gypsum Board and Hardboard:

1. Primer: MPI 50(Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) and MPI 46 (Interior Enamel Undercoat) in shower and bathrooms.
2. Surfaces scheduled to receive vinyl coated fabric wallcovering: Use MPI 45 (Interior Primer Sealer), MPI 46 (Interior Enamel Undercoat).

3.6 EXTERIOR FINISHES

A. Apply following finish coats where specified.

B. Wood:
   1. Do not apply finish coats on surfaces concealed after installation, top and bottom edges of wood doors and sash, or on edges of wood framed insect screens.
   2. Two coats of MPI 10 Exterior Latex, Flat (AE)), MPI 11 (Exterior Latex, Semi-Gloss (AE)) on exposed surfaces.

3.7 INTERIOR FINISHES

A. Apply following finish coats over prime coats in spaces or on surfaces specified in the finish documents
B. Metal Work:
   1. Apply to exposed surfaces.
   2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
   3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
      a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.
C. Gypsum Board:
   1. One coat of MPI 45 (Interior Primer Sealer)m MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 52 (Interior Latex, MPI Gloss level 3 (LE)).
   2. One coat of MPI 45 (Interior Primer Sealer) and MPI 46 (Interior Enamel Undercoat)
D. Wood:
   1. Sanding:
      a. Use 220-grit sandpaper.
      b. Sand sealers and varnish between coats.
      c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.
   2. Sealers:
      a. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
      b. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
      c. Sand as specified.
   3. Paint Finish:
      a. One coat of MPI 45 (Interior Primer Sealer) and MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 54 (Interior Latex, Semi-Gloss (LE)).
E. Miscellaneous:
   1. Apply where specified in finish documents.

3.8 REFINISHING EXISTING PAINTED SURFACES

A. Clean, patch and repair existing surfaces as specified under surface preparation.
B. Remove and reinstall items as specified under surface preparation.
C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one coat of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss) and MPI 71 (Polyurethane, Moisture Cured, Clear Flat (PV)).
G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
I. Sand or dull glossy surfaces prior to painting.
J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.9 PAINT COLOR

A. Color and gloss of finish coats is specified in finish documents.
B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
C. Coat Colors:
   1. Color of priming coat: Lighter than body coat.
   2. Color of body coat: Lighter than finish coat.
   3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
   1. Paint to match color of casework where casework has a paint finish.
   2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.10 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.

B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified under paragraph H, colors.
C. Paint various systems specified in Division 02 – EXISTING CONDITIONS, Division 21 – FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 – HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 – ELECTRONIC SAFETY AND SECURITY.
D. Paint after tests have been completed.
E. Omit prime coat from factory prime-coated items.
F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
G. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.
H. Color:
   1. Paint items having no color specified in interiors finish specifications to match surrounding surfaces.
   2. Paint colors in interior finishes specifications, except for following:
      a. White .....Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
      b. Gray: .....Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
      c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
      d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
      e. Federal Safety Orange: .Entire lengths of electrical conduits containing feeders 600 volts or more.
      f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

I. 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. Paint electrical conduits containing cables rated 600 volts or more using two coats of MPI 9 (Exterior Alkyd Enamel (EO)), MPI 8(Exterior Alkyd, Flat (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)).

3.11 BUILDING AND STRUCTURAL WORK FIELD PAINTING

A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11 B.
   1. Painting and finishing of new and existing work including colors and gloss of finish selected as shown in interior finishes specifications.
   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. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space except shingles.
   5. 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. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
10. Face brick.
11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.
13. Ceilings, walls, columns in interstitial spaces.
14. Ceilings, walls, and columns in pipe basements.
15. Wood Shingles.

3.12 IDENTITY PAINTING SCHEDULE

A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.

1. Legend may be identified using 2.1 G options or by stencil applications.
2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12 000 mm (20 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
3. Locate Legends clearly visible from operating position.
4. Use arrow to indicate direction of flow.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
   a. High Pressure - 414 kPa (60 psig) and above.
   b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
   c. Low Pressure - 103 kPa (14 psig) and below.
   d. Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

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

Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup
Hot Water Heating Return		Yellow	Black	H. W. Htg Ret
Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade		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		Yellow	Black	Vent
Alkali		Yellow	Black	Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Yellow	Black	Acid Waste
Vent		Yellow	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				

Sprinkler	Red	White	Auto Spr
Standpipe	Red	White	Stand
Sprinkler	Red	White	Drain

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, 15000 and 25000.
8. See Divisions 21, 22, 23, 26, 27 and 28 for methods of identification, legends, and abbreviations.

B. Fire and Smoke Partitions:
1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
3. Locate not more than 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.
4. Use semigloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:
1. Apply stenciled number and letters to correspond with grid numbering and lettering shown.
2. Paint numbers and letters 100 mm (4 inches) high, locate 450 mm (18 inches) below overhead structural slab.
3. Apply on four sides of interior columns and on inside face only of exterior wall columns.
4. Color:
   a. Use black on concrete columns.
   b. Use white or contrasting color on steel columns.

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.

APPENDIX

Coordinate the following abbreviations used in Section 09 91 00, PAINTING, with other Sections, especially Section 09 06 00, SCHEDULE FOR FINISHES and other COATING SECTIONS listed. Use the same abbreviation and terms consistently.

Paint or coating	Abbreviation
Alkyd Flat	Ak (MPI 49)
Alkyd Semigloss Enamel	SG (MPI 47)
Exterior Oil	EO (MPI 9 – gloss/MPI 8 – flat/MPI 94 – semigloss)
Epoxy Coating	EC (MPI 77 – walls, floors/MPI 108 – CMU, concrete)
Floor Enamel	FE (MPI 27 – gloss)
Latex Emulsion	LE (MPI 53, flat/MPI 52, eggshell/MPI 54, semigloss/MPI 114, gloss Level 6
Latex Gloss	LG (MPI 114)
Latex Semigloss	SG (MPI 141)
Plastic Floor Coating	PL
Wood Stain	WS (MPI 90)

Verify abbreviations used in the following coating sections:

Section 09 96 59,	HIGH-BUILD GLAZED COATINGS	GC
Section 09 94 19,	MULTICOLOR INTERIOR FINISHING	MC

- - - E N D - - -

SECTION 22 01 00
BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. This section expands and supplements requirements specified in Division 1.

B. Related Sections include the following:

1. Division 1 in its entirety.

1.2 SUMMARY

A. This Section includes the following:

1. Allowances.
2. Alternates.
3. Change Orders.
4. Closeout Documentation.
5. Codes, Permits & Inspections, and Labeling.
6. Color Selections.
7. Contractor Qualifications.
8. Coordination Drawings.
9. Definitions.
10. Deliveries.
11. Discrepancies.
12. Electronic Media.
13. Job Site Safety
14. Job Site Security
15. Keys.
16. Operating and Maintenance Manuals.
17. Pre-Bid Meeting.
18. Record Documents and As-Built Drawings.
19. Requests For Information.
20. Shop Drawings.
21. Spare Parts.
22. Substitutions.
23. Training.
24. Unit Pricing.
25. Warranties.

1.3 ALLOWANCES

A. Refer to Division Section 1 for a complete listing and description of each allowance pertaining to work of this Contractor.

1.4 ALTERNATES

A. Refer to Division Section 1 for a complete listing and description of each alternate pertaining to work of this Contractor.

1.5 CLOSEOUT DOCUMENTATION

A. Submit in triplicate all of the information listed below at a minimum along with all the requirements stated elsewhere in Division 1, and Division 22:

1. Operations and Maintenance (O&M) manuals as outlined below in this specification.
2. Certification letter that all plumbing equipment has been tested and is operational according to the plans and specifications.
3. Certification letter that all punch list items have been corrected.
4. Certification letter that all clean-up relating to plumbing work has been performed.
5. Certification letter that no asbestos or any materials containing asbestos have been used in the plumbing portion of the work.
6. Contractor’s notarized affidavit of payment of debts and claims.
7. Contractor’s notarized affidavit of release of liens.

1.6 CODES, PERMITS & INSPECTIONS, AND LABELING

A. P.C. shall be responsible for contacting The Owner and other appropriate authorities for scheduling all required tests and inspections.

B. All work shall be performed in accordance with the latest editions of International Plumbing Code and applicable federal, state, county, and city codes and requirements by the Owner.

C. The Contractor is reminded that since the International Plumbing Code is by statutory inclusion a part of the laws of the federal government, they bear a prime responsibility to comply with it even when the plans or specifications denote an apparent violation. This should be observed carefully and continuously, particularly during estimating for proposal, and any discrepancies should be brought to the attention of the engineer for resolution.

D. Contractor shall include in his/her bid all costs for building permits, inspections, and prepays including utility fees unless otherwise noted herein or in Division 1.

E. Contractor shall coordinate and schedule all required State, County, City, County and Engineer inspections in a timely manner so as to not “cover up” work to be inspected and to not “hold up” work to be performed by other trades.

F. All plumbing equipment, materials, and devices shall be labeled by an approved third party testing agency.

G. After site observations are made, the Engineer will provide field reports and generate deficiency logs to the Contractor. These items are to be addressed by the Contractor within (14) days of receipt, unless otherwise agreed upon in writing. When the items are corrected, the items shall be initialed and dated by the plumbing “foreman” and not by the plumbing “project manager.”

1.7 COLOR SELECTIONS

A. All plumbing equipment involving a color selection shall be brought to the attention of the Engineer, via a shop drawing submittal, for their direction. Contractor shall provide the Engineer with a list full range of colors that can be selected from. Contractor shall provide color chips, samples, color brochures, etc. for the Engineer's use.

B. All plumbing equipment involving color selection shall be submitted at one time, along with the other finishes for other disciplines needing a color selection so that the Engineer has all the information together to make a complete decision.

C. Some examples of plumbing equipment needing a color selection are:

1. Fixtures
2. Faucets

1.8 CONTRACTOR QUALIFICATIONS

A. Contractor shall have been in business for at least five years and have completed at least three projects of similar size and scope.

B. Contractor shall have proper business and employee licenses in order to perform work in the state.

C. Refer to individual specification sections for additional qualifications relevant to each specification section.

D. At least one qualified journeyman, designated as the superintendent, shall be present at all times during the execution of the work.

E. In acceptance or rejection in any portion of the plumbing work, no allowance will be made for lack of skill on the part of the workmen.

1.9 COORDINATION DRAWINGS

A. A meeting shall be arranged by the General Contractor and take place prior to the G.C. starting the coordination drawings. This meeting shall include at a minimum the G.C., the Engineer, Owner's representative such that we can confirm the requirements of the coordination drawings prior to them being submitted.

B. P.C. shall coordinate with the G.C. and other trades so that the following lists of items can be indicated on a common set of plans. Floor plans and sections are to be drawn to scale in all congested areas (such as corridors, chases, and equipment rooms) and specific areas noted in these documents. These shall be submitted collectively from all disciplines into one overall document for review by the Engineer on an as needed basis or where specifically directed within the Contract Documents. These coordination drawings

shall be submitted for review prior to any other individual product data or fabrication drawings. Show the following at a minimum:

1. Ceiling.
2. Floor.
3. Roof or floor decking above.
4. Structural elements.
5. Light fixtures.
6. Large electrical or telecom conduits and/or pull boxes.
7. HVAC ductwork.
8. HVAC equipment above ceiling, with service clearances indicated.
9. HVAC piping.
10. Plumbing piping.
11. Fire protection piping.
12. Mounting racks and support assemblies for associated piping/ductwork.

C. It is important to note that ductwork/piping/cable tray, etc. cannot be fabricated, until the coordination drawings have been compiled, submitted, and approved. Any material procurement or installation work commenced prior to approval is taken at the risk of the Contractor and may have to be modified/moved at their cost.

1.10 DEFINITIONS

A. Where the word “provide” is used relating to a system or piece of equipment, it shall be understood to mean the furnishing and installing of the system or equipment.

B. Where the word “furnish” is used relating to a system or piece of equipment, it shall be understood to mean supply to the project only, for installation under other Divisions as part of this contract.

C. Where the word “install” is used relating to a system or piece of equipment, it shall be understood to mean to place and put in service equipment furnished under other Divisions as part of this contract.

D. Where the phrase “as directed” is used, it shall be understood to mean direction given to the Contractor by the Engineer, or Owner.

E. Where the phrase “as indicated” is used, it shall be understood to mean as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as “shown”, “noted”, “scheduled” and “specified” have the same meaning as “indicated”, and are used to assist the reader in locating particular information.

F. Where the word “Contractor” is used, it shall be understood to mean the contractor responsible for all Division 22 specifications and plumbing drawings, unless otherwise noted. For projects where one prime contract is awarded, the Prime Contractor shall be responsible for all Division 22 work included in these specifications and plumbing drawings.

G. Where the term “P.C.” is used, it shall be taken as a guide for the scope normally performed by the Plumbing Subcontractor, whereas when the term “G.C.” is used, it shall be taken as a guide for the scope normally performed by the General Contractor. For projects where multiple prime contracts are awarded, the Plumbing Contractor shall be responsible for all Division 22 work included in these specifications and plumbing drawings.

1.11 DELIVERIES

A. All deliveries for equipment ordered by the Contractor shall be accommodated by the Contractor. Contractor shall coordinate deliveries and storage space for equipment during hours that the Contractor is on site. The Owner will not be responsible for receiving/unloading equipment whether during working hours or after hours, unless otherwise closely coordinated up front with the Owner. Contractor shall also provide their own means of unloading equipment.

1.12 DISCREPANCIES

A. Should it appear that there is a discrepancy between or within the Division 22 drawings, and/or Division 22 specifications, and/or the local Authority Having Jurisdiction’s interpretations, and/or local Utility Companies regulations concerning the nature, quality or extent of materials or work to be furnished and/or installed, and such discrepancy is not brought to the Engineer’s attention during Bidding for a formal written Addendum clarification, this Contractor shall base his/her bid on performing the work in the manner having the higher cost or more stringent option. The Engineer shall then have the option during construction of selecting either of the manners shown and/or specified at no additional cost to the Owner. In the event the lower cost manner is selected, a credit shall be due the Owner in the amount of the difference between the lower cost and higher cost manner. All discrepancies shall be called to the attention of the Engineer before proceeding with work affected thereby.

B. This specification section is not meant to contradict other specification sections that describe similar scopes of work. The intent of this section is to clarify any basic issues that may have been omitted in other Divisions or are not entirely clear as to how they affect the Contractor(s) of this Division.

C. The design drawings, as submitted, are diagrammatic and are not intended to show exact location of equipment, fixtures, valves, pumps, etc. unless dimensions are given. Drawings are not to be scaled. Verify all exact locations with Architect prior to rough-in.

1. Equipment shall be installed along the general arrangement indicated on the drawings, and in accordance with the manufacturer's instructions.

a. Provide at least the minimum manufacturers recommended and code required clearance around the equipment for normal maintenance.
b. Locate and arrange equipment in relationship to other system components to assure that the equipment will be operating under the best possible conditions to meet the scheduled performance requirements.

2. Piping is to be installed along the general plans shown on the drawings keeping in mind the constraints of the available space and the need to coordinate with the work of other trades. Additional elbows, transitions, and offsets shall be provided as necessary to meet space constraints and to facilitate the work of other trades.

D. Plumbing equipment, specified hereinafter as shown on the drawings shall be furnished and installed by this Contractor, unless specifically indicated to the contrary.

E. Occasionally, certain references may be indicated on the Drawings to items which are suggested to be furnished and/or installed by various subcontractors. This is done to assist the applicable Prime Contractor in organizing his subcontractor's bids. However, no attempt has been made, nor is it implied, that this specification or plans are attempting to specifically divide all responsibilities for subcontractors. It is the Prime Contractor's responsibility that all items covered on plumbing plans and Division 22 specifications are included in his bid and are coordinated with his subcontractors. No consideration will be given for Prime Contractor's failure to include all applicable plumbing work in his bid.

F. Where more than one manufacturer is named for major items of equipment, the manufacturer noted on the Drawings has been used as a basis for design. If another manufacturer is used, other than the one named on the Drawings, it shall be the responsibility of this contractor to ensure that the equipment will fit the space with all legal and required service clearances, or bear the expense to change the space and structure to accommodate equipment used.

1.13 ELECTRONIC MEDIA

A. Where the Contractor is required to produce full size drawings for shop drawings, as-builts, or to outline the work involved for his/her use (i.e. piping, fixtures, faucets, valves, etc.), the electronic drawings can be obtained from the Government. The file type will be coordinated with the Government. The Government will deliver the media on a read-only CD to the Contractor.

1.14 JOB SITE SAFETY

A. The Contractor and not the Engineer is responsible for all job site safety relating to his or her work. The Contractor shall be familiar with all safety requirements, such as OSHA regulations, and comply accordingly. The Contractor shall coordinate providing of all personal protection equipment with their employees.

1.15 JOB SITE SECURITY

A. The Contractor shall be responsible for all security of their employees, materials, tools, and equipment. Contractor shall lock up and store materials, tools, and equipment accordingly.

1.16 OPERATING AND MAINTENANCE MANUALS

A. As part of closeout procedures the Contractor shall turn over to the Engineer for approval a minimum of three (3) copies of operation and maintenance manuals. Refer to Division 1 for quantity of O&M manuals that may exceed the minimum three. The approved manuals shall then be turned over to the Owner, upon review of the Engineer. These O&M manuals shall consist of 3-ring binders with loose leaf information, permanent covers, clearly identified and indexed with table of contents, tabs for each section, containing the following at a minimum:

1. Complete description of the automatic operation, manual operation, and safety features built into the system.
2. Step-by-step procedures for start-up, operation, and shut-down for each system and piece of equipment.
3. Complete list of diagnostic and troubleshooting procedures for systems and major equipment.
4. Recommended preventative maintenance program for each piece of plumbing equipment, and each system, including items to be inspected and serviced, frequency of inspection and servicing, the type of servicing required, and types of lubricants to be used.
5. As-built material list including make and model numbers.
6. Catalog brochures for all components with specific parts used, marked clearly.
7. Supplier’s and manufacturer’s conformance of specifications and drawings certificates.
8. Copy of all test reports by manufacturer and contractor.
9. Performance data, curves, ratings.
10. Dimensional drawings.
11. Wiring and block diagrams, indicating factory wiring separate from field wiring.
12. Required settings.
13. Manufacturer's descriptive literature.
14. Manufacturer's maintenance and service manuals.
15. Multiple copies of Manufacturer’s **original** installation and maintenance manual that comes with the equipment itself.
16. Spare parts bill of material.
17. Owner’s sign off sheets for receipt of spare parts and training.
18. Name of service agency and installer complete with an emergency service phone number for nights, weekends and holidays.
19. Final approved shop drawings.
20. Warranties and guarantees.
21. Copies of all inspection reports and checkout forms by AHJs, inspectors, utilities, manufacturers, etc.
22. Owner’s training video tapes, if applicable.
23. Any other pertinent information that the Contractor or Manufacturer feels is important for the Owner to know about the plumbing equipment or system.

1.17 PRE-BID MEETING

A. All persons wishing to submit quotations for work in accordance with these plans and specifications are strongly urged to attend the pre-bid meeting for further insight into the project.

1.18 RECORD DOCUMENTS AND AS-BUILT DRAWINGS

A. The Contractor shall maintain on site at all times a dedicated space for a current set of red-lined as-built specifications and drawings to record revisions to the original set of construction documents.

B. The Engineer or Owner may at any time ask to review the as-built drawings and specifications during construction.

C. These as-built plans and specifications shall be in addition to the sets used by the installing personnel in carrying out their day to day work on the project. The projected location of every pipe, valve, fixture or item of equipment to be installed under this contract shall be checked against the plans and specifications of all the other trades as well as by daily conference with workmen and supervisors of all other trades to the extent that any conflicts or uncertainties about locations are resolved before work is installed. Ceiling construction installation shall be made in accord with reflected ceiling plans and/or instructions by the Engineer’s representatives on the site. Moving of items from locations shown, rerouting, or changes to accomplish any work as shown on plans or specifications in order to accomplish this coordination shall not be a cause for claim for additional compensation for the work.

D. As part of the closeout procedures, the Contractor shall take a clean set of drawings and produce one set of as-built specifications and drawings in red ink with a signed Record Drawing stamp. These drawings are to be turned over to the Owner. These documents shall be called the Record Documents.

1.19 REQUESTS FOR INFORMATION

A. When a question, clarification, or discrepancy arises after the Bid has been awarded, the Contractor shall submit in writing to the Engineer or the Owner/Owner’s Representative an RFI to document the issue. The RFI must indicate the drawings and/or specification sections being referenced and eluded to. Upon receipt, the Engineer will then respond back to the RFI in writing as soon as possible given the circumstances of the RFI. Contractor shall take proper measures to initiate RFI in a timely fashion in order for the Engineer to properly evaluate.

1.20 SHOP DRAWINGS

A. Within 30 calendar days following Contract approval or Notice To Proceed and prior to submitting shop drawings, this Contractor shall submit to the Engineer a list of proposed manufacturers and

(sub) Contractors for each specification section and each major piece of equipment for approval. Along with the above information, Contractor to submit the Pay Application Schedule Of Values and a Shop Drawing Submittal Schedule to the Engineer for their review coordination.

B. All shop drawings shall be submitted to the Engineer for review within 60 days of receiving a contract, so as not to delay the project.

C. This Contractor shall review, stamp and sign with his/her approval and submit in an orderly sequence so as to cause no delay in the work or in the work of any other Contractor, all submittal information and samples required by the contract documents. Submittal information not stamped with Contractor approval will be returned for reprocessing.

D. Contractor shall **not** begin fabrication or rough-in work or release of materials which requires submittals until return of submittals with Engineer's approval.

E. In approving the submittals, the Contractor guarantees that the submittals accurately and completely represent the equipment and materials to be installed.

F. Shop drawings shall be submitted for ALL material items as outlined in these specifications. Any deviations from contract requirements must be clearly indicated on shop drawings, and justification for their consideration must be included.

G. Acceptance of submittal items will not preclude rejection of those items upon later discovery that their suitability for the application or ability to meet the requirements of these specifications was misrepresented in the submittals.

H. Submittals for equipment shall include detailed dimensional drawings which completely and accurately represent the specific piece of equipment to be supplied and all required clearances. When more than one piece of similar equipment is to be supplied, provide accurate dimensional drawings for each unique size and/or configuration of the equipment.

I. In checking shop drawings, the Engineer will make every effort to detect and correct errors, omissions and inaccuracies in such drawings, but his/her failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for the proper and complete installation in accordance with the intent of the Contract Documents.

J. The shop drawings will be reviewed by the Engineer per specification section. The Contractor shall bind together multiple specification section shop drawings if they so desire, however a separate shop drawing review sheet shall be issued for each section. This will help identify the issues involved with each item, rather than accepting or rejecting the entire submittal as a whole. However, a single specification section shop drawing shall

not be broken out and submitted as partial shop drawings as the entire shop drawing for that specification section must be submitted together. If the Contractor submits multiple copies of partial shop drawings, they will not be reviewed by the Engineer and will be sent back as rejected.

K. In the event of multiple shop drawing (re)submissions for the same equipment or specification section, the Engineer reserves the right to require additional fee for a third review of the same shop drawing if the Contractor continues to not adhere to the shop drawing requirements listed in the specifications and the Engineer’s prior review comments.

L. Contractor shall maintain at the site a complete set of all shop drawings, equipment cut sheets, and installation data. Installing personnel shall study this data before and during installation and rough-in so as to prepare for the proper fit and function upon completion.

M. Coordinate the quantity of shop drawings to be submitted with Architect at the outset of the project, ensuring that the Engineer can retain at least one copy for his/her records.

N. The Engineer will perform due diligence in reviewing shop drawings as quickly as they are received. However, if the majority of the shop drawings are received at the same time, the Contractor shall provide the Engineer with a priority list for their use in reviewing the shop drawings in that order to best expedite the project.

O. Contractors options:

1. For products specified only by reference standard, Contractor shall select any product meeting that standard.
2. For products specified by naming several manufacturers or manufacturer’s make and model numbers, select any one of the products or manufacturers named. Be aware that just because a manufacturer is listed does not guarantee that they comply with all of the specifications. The manufacturer still has to illustrate through shop drawings that they meet all the required criteria in the specifications prior to approval.
3. For products specified by naming one or more products or manufacturers and "or equal", Contractor must submit a request for substitutions for any product or manufacturer not specifically named during the Bidding process for formal pre-approval.

1.21 SPARE PARTS

A. Refer to individual specification sections for quantity and description of required spare parts.

B. Label each box of spare parts clearly identifying the contents and turn over to Owner. Prepare a bill of material for all spare parts and have Owner sign off receiving the inventory. Include the spare parts sign off sheet as part of the closeout documents.

1.22 SUBSTITUTIONS

A. Bids concerning the use of substitute products must be accompanied by complete specifications and performance characteristics covering these products, together with such available test data and experience records as may be helpful to the Engineer in evaluating the quality and/or suitability of the proposed products, including:

1. Comparison of the qualities of the proposed substitution with that specified.
2. Changes required in other elements of the work because of the substitution.
3. Effect on the construction schedule.
4. Cost data comparing the proposed substitution with the product specified.
5. Availability of maintenance service, and source of replacement materials.

B. A request for a substitution constitutes a representation that the Contractor:

1. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
2. Will provide the same warranties or bonds for the substitution as for the product specified.
3. Will coordinate the installation of an accepted substitution into the work, and to make the work complete in all respects.
4. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
5. Absorb all costs incurred by the substitution when affecting other trades, including but not limited to electrical, structural and architectural, etc.
6. Absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or missized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

C. Where more than one make or name is mentioned as being acceptable, it shall be understood that only the name or make referring to the manufacturer's model numbers or sizes shall be considered the "Specified Standard". It shall be further understood that other makes and names, even though mentioned, have not been checked for detail and that their size and arrangement are the Contractor's responsibility the same as a proposed substitute item.

D. The intent of this section is to make the specifications open to all available makes of material and apparatus during the bidding period. Substitutions will only be allowed to be submitted for pre-approval to the Engineer up to ten days prior to bid opening. The substitutions will be reviewed at that time by the Engineer with reasonable promptness. Substitution materials and equipment

will only be incorporated into the project if the Engineer pre-approves the intent of the shop drawing(s) and lists the manufacturer's make and model on an official written and distributed Addendum. No substitutions will be reviewed by the Engineer during construction.

1.23 TRAINING

A. Refer to individual specification sections for quantity and description of required Owner's Training.

B. Contact and schedule with the Owner two weeks ahead of time for all training. Stress to the Owner to have any and all relevant personnel, teaching staff, and maintenance staff available for the training.

C. Personnel conducting training shall be: trained and experienced in maintenance and operation of equipment, familiar with specification requirements, skilled as a technical writer to the extent required to communicate essential data, and skilled as a draftsperson competent to prepare required drawings.

D. Distribute and review operations and maintenance manuals, shop drawings, record drawings, warranties, spare parts, keys, etc. at that time. Provide hands on demonstration of equipment operation, maintenance, troubleshooting, and features. Review spare parts inventory and contact information for future maintenance. Prepare a written sign off sheet for all attendees to sign having witnessed the training. Include the training sign off sheet as part of the closeout documents. Videotape all training and provide videotape to Owner as part of the closeout procedure.

1.24 WARRANTIES

A. Refer to individual specification sections for quantity and description of required Warranties.

B. Prepare and deliver to the Owner all formal written certificates of warranty clearly stating the scope of the warranty and time period.

C. All warranties to commence at the time of Final Completion regardless of startup time or turnover to the Owner. Provide monies in the bid as required to accommodate the start of this warranty period.

D. All equipment under this Division of work shall be warranted for a minimum of one year or manufacturer's minimum warranty whichever is greater, unless otherwise noted. During this warranty period, the Contractor shall replace any and all defective equipment and parts at no additional cost to the Owner.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 22 01 00

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Plumbing demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and

AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

   a. Cascade Waterworks Mfg. Co.
   b. Dresser Industries, Inc.; DMD Div.
   c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
   d. JCM Industries.
   e. Smith-Blair, Inc.
   f. Viking Johnson.
   g. Or approved equal as determined by the Engineer.

2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

1. Manufacturers:

   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Eclipse, Inc.
   d. Epco Sales, Inc.
   e. Hart Industries, International, Inc.
   f. Watts Industries, Inc.; Water Products Div.
   g. Zurn Industries, Inc.; Wilkins Div.
   h. Or approved equal as determined by the Engineer.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

1. Manufacturers:

    a. Capitol Manufacturing Co.
    b. Central Plastics Company.
    c. Epco Sales, Inc.
    d. Watts Industries, Inc.; Water Products Div.
    e. Or approved equal as determined by the Engineer.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.
    e. Or approved equal as determined by the Engineer.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Manufacturers:

    a. Calpico, Inc.
    b. Lochinvar Corp.
    c. Or approved equal as determined by the Engineer.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Manufacturers:

    a. Perfection Corp.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Co., Inc.
    d. Victaulic Co. of America.
    e. Or approved equal as determined by the Engineer.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

    a. Advance Products & Systems, Inc.

b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.
e. Or approved equal as determined by the Engineer.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
    g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
    h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw or spring clips.

j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:

a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge and set screw or spring clips.
i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
   b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

      1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.10 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 22 05 00

SECTION 22 05 16
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Flexible-hose packless expansion joints.
2. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Welding certificates.

D. Product Certificates: For each type of expansion joint, from manufacturer.

E. Maintenance Data: For expansion joints to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 PACKLESS EXPANSION JOINTS

A. Flexible-Hose Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flex-Hose Co., Inc.
   b. Flexicraft Industries.
   c. Flex Pression Ltd.
   d. Metraflex, Inc.
   e. Unisource Manufacturing, Inc.
   f. Or approved equal as determined by the Engineer.

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with solder-joint end connections.

   a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.
   b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 500 psig at 450 deg F (3450 kPa at 232 deg C) ratings.

5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Copper-alloy fittings with threaded end connections.

   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.
   b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F (2890 kPa at 21 deg C) and 315 psig at 450 deg F (2170 kPa at 232 deg C) ratings.

2.2 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flex-Hose Co., Inc.
b. Flexicraft Industries.
c. Metraflex, Inc.
d. Unisource Manufacturing, Inc.
e. Or approved equal as determined by the Engineer.

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Stud: Threaded, zinc-coated carbon steel.
b. Expansion Plug: Zinc-coated steel.
c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.2 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 22 05 16

SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.

B. Related Sections:

1. Division 21 Section "Facility Fire-Suppression Water-Service Piping" for fire-protection water-service meters outside the building.
2. Division 21 fire-suppression piping Sections for fire-protection pressure gages.
3. Division 22 Section "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Certificates: For each type of meter and gage, from manufacturer.

C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Trerice, H. O. Co.

b. Or approved equal as determined by the Engineer.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch (152-mm) nominal size.
4. Case Form: Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.

   a. Design for Thermowell Installation: Bare stem.

9. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Type: Stepped shank unless straight or tapered shank is indicated.
5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
6. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length required to match thermometer bulb or stem.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Flo Fab Inc.
   e. Trerice, H. O. Co.
   f. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   g. Weiss Instruments, Inc.
   h. Or approved equal as determined by the Engineer.

2. Standard: ASME B40.100.
3. Case: Liquid-filled Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.

I. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:

1. Compact-style, liquid-in-glass type.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be the following:

1. Compact-style, liquid-in-glass type.

C. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C).

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:

1. Liquid-filled Sealed, direct-mounted, metal case.

B. Pressure gages at suction and discharge of each domestic water pump shall be the following:

1. Liquid-filled Sealed, direct-mounted, metal case.
2. Sealed, direct remote-mounted, plastic case.
3. Test plug with chlorosulfonated polyethylene synthetic EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Water Piping: 0 to 100 psi (0 to 600 kPa).

END OF SECTION 22 05 19

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze lift check valves.
4. Bronze swing check valves.
5. Bronze globe valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. DynaQuip Controls.
   d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Red-White Valve Corporation.
   i. Or approved equal as determined by the Engineer.

2. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Brass.
   i. Ball: Chrome-plated brass.
   j. Port: Full.

B. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
   d. Hammond Valve.
   e. Milwaukee Valve Company.
   f. Or approved equal as determined by the Engineer.

2. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded.

g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

C. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Red-White Valve Corporation.
b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
c. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Three piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

D. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
b. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Three piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corporation.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
i. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
g. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

C. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Red-White Valve Corporation.
f. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

D. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.4 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Red-White Valve Corporation.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: NBR, PTFE, or TFE.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Powell Valves.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.
l. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).

c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corporation.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
i. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.6 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Red-White Valve Corporation.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
i. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem and Disc: Bronze.

f. Packing: Asbestos free.
g. Handwheel: Bronze or aluminum.

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. NIBCO INC.
d. Red-White Valve Corporation.
e. Or approved equal as determined by the Engineer.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Bronze or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves.
2. Throttling Service: Globe valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe All sizes:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One, Two, or Three piece, full port, brass or bronze with brass, bronze, or stainless-steel trim.
3. Bronze Swing Check Valves: Class 125, bronze or nonmetallic disc.
4. Bronze Globe Valves: Class 125, bronze or nonmetallic disc.

END OF SECTION 22 05 23

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.
5. Pipe positioning systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Pipe stands. Include Product Data for components.
5. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code—Steel” and ASME Boiler and Pressure Vessel Code: Section IX.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.
15. Or approved equal as determined by the Engineer.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.
8. Or approved equal as determined by the Engineer.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.
7. Or approved equal as determined by the Engineer.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.
f. Or approved equal as determined by the Engineer.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.
g. Or approved equal as determined by the Engineer

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:

a. MIRO Industries.
b. Or approved equal as determined by the Engineer.

C. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.
c. Portable Pipe Hangers.
d. Or approved equal as determined by the Engineer.

2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with stainless-steel, roller-type pipe support.

D. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers:

a. Portable Pipe Hangers.
b. Or approved equal as determined by the Engineer.

2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

E. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.
4. Or approved equal as determined by the Engineer.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and

lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).

c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 Painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 05 29

SECTION 22 05 48
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Freestanding and restrained spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Spring hangers.
8. Spring hangers with vertical-limit stops.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Seismic snubbers.
12. Restraining braces and cables.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading: See Drawings.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as

evaluated by an agency acceptable to authorities having jurisdiction.

b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.

3. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.
10. Or approved equal as determined by the Engineer.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

F. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

G. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

H. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

I. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.
5. Kinetics Noise Control.
6. Loos & Co.; Cableware Division.
7. Mason Industries.
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.
10. Or approved equal as determined by the Engineer.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.

D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

G. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

J. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanized metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches (3.2 mm).
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
3. Brace a change of direction longer than 12 feet (3.7 m).

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of sprint isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 22 05 48

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semi rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Aluminum.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) Aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of plumbing equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Domestic Water Piping:

a. Background Color: Green.
b. Letter Color: White.

2. Sanitary Waste and Storm Drainage Piping:

a. Background Color: White.
b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches (38 mm) 2 inches (50 mm), round.
b. Hot Water: 1-1/2 inches (38 mm) 2 inches (50 mm), round.

2. Valve-Tag Color:

a. Cold Water: Natural.

b. Hot Water: Natural.

3. Letter Color:

a. Cold Water: Black.
b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

   a. Cellular glass.
   b. Mineral fiber.

2. Adhesives.
3. Mastics.
4. Sealants.
5. Factory-applied jackets.
6. Tapes.
7. Securements.
8. Corner angles.

B. Related Sections include the following:

1. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cell-U-Foam Corporation; Ultra-CUF.
   b. Pittsburgh Corning Corporation; Foamglas Super K.
   c. Or approved equal as determined by the Engineer

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
6. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Fibrex Insulations Inc.; Coreplus 1200.
   b. Johns Manville; Micro-Lok.
   c. Knauf Insulation; 1000(Pipe Insulation.
   d. Manson Insulation Inc.; Alley-K.
   e. Owens Corning; Fiberglas Pipe Insulation.
   f. Or approved equal as determined by the Engineer

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass, Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; CP-96.
   b. Foster Products Corporation, H. B. Fuller Company; 81-33.
   c. Or approved equal as determined by the Engineer

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.
f. Or approved equal as determined by the Engineer

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.
f. Or approved equal as determined by the Engineer

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.
g. Or approved equal as determined by the Engineer

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.4 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; CP-76.
   b. Foster Products Corporation, H. B. Fuller Company; 30-45.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.
   f. Vimasco Corporation; 750.
   g. Or approved equal as determined by the Engineer.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

B. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; Metal Jacketing Systems.
   b. PABCO Metals Corporation; Surefit.
   c. RPR Products, Inc.; Insul-Mate.
   d. Or approved equal as determined by the Engineer

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

   a. Sheet and roll stock ready for shop or field sizing.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
   d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
   e. Factory-Fabricated Fitting Covers:

      1) Same material, finish, and thickness as jacket.

2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
   b. Compac Corp.; 104 and 105.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
   e. Or approved equal as determined by the Engineer

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.7 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.
   d. Or approved equal as determined by the Engineer

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.
      5) Or approved equal as determined by the Engineer

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.
      5) Or approved equal as determined by the Engineer

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.
      4) Or approved equal as determined by the Engineer

   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
   c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

2.8 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

    1. Install insulation continuously through hangers and around anchor attachments.
    2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
    3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
    4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

    1. Draw jacket tight and smooth.
    2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
    3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps

with outward clinching staples along edge at 2 inches (50 mm) o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

Q. Repair existing insulation that is damaged as a result of new work.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Firestopping" for Firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient

services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. Install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with

additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications,

install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.

b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

C. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed: (Mechanical Room)

1. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.

END OF SECTION 22 07 00

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. LLDPE: Linear, low-density polyethylene plastic.

D. NBR: Acrylonitrile-butadiene rubber.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class (es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) ANACO.
2) Clamp-All Corp.
3) Ideal Div.; Stant Corp.
4) Mission Rubber Co.
5) Tyler Pipe; Soil Pipe Div.
6) Or approved equal as determined by the Engineer.

2.5 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

B. Drainage Fittings: ASME B16.12, threaded, cast-iron drainage pattern.

C. Grooved-Joint Systems:

1. Manufacturers:

   a. Anvil International.
   b. Star Pipe Products; Star Fittings Div.
   c. Victaulic Company.
   d. Ward Manufacturing, Inc.
   e. Or approved equal as determined by the Engineer.

2. Grooved-End, Steel-Piping Fittings: ASTM A 47/A 47M, malleable-iron casting; ASTM A 106, galvanized-steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; and heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

E. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

F. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

G. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

H. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are

installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

E. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.

8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

I. Install supports for vertical steel piping every 15 feet (4.5 m).

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing

is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 13 16

SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Air-admittance valves.
4. Roof flashing assemblies.
5. Through-penetration firestop assemblies.
6. Miscellaneous sanitary drainage piping specialties.
7. Flashing materials.
8. Solids interceptors.

B. Related Sections include the following:

1. Division 22 Section "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.
    g. Or approved equal as determined by the Engineer.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Light Commercial Operation.

f. Zurn Plumbing Products Group; Specification Drainage Operation.
g. Or approved equal as determined by the Engineer.

2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Light Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
g. Or approved equal as determined by the Engineer.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Light Commercial Operation.
   g. Or approved equal as determined by the Engineer.

2. Standard: Refer to schedule on Drawings.

2.3 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ayrlett, LLC.
   b. Durgo, Inc.
   c. Oatey.
   d. ProSet Systems Inc.
   e. RectorSeal.
   f. Studor, Inc.
   g. Or approved equal as determined by the Engineer.

2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected fixture or branch vent piping.

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Acorn Engineering Company; Elmdor/Stoneman Div.
   b. Thaler Metal Industries Ltd.
   c. Or approved equal as determined by the Engineer.

B. Description: Manufactured assembly made of 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 6 inches (150 mm) from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.5 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ProSet Systems Inc.
   b. Or approved equal as determined by the Engineer.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.6 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

   a. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
   b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

2. Size: Same as connected stack vent or vent stack.

2.7 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.8 SOLIDS INTERCEPTORS

A. Solids Interceptors:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Rockford Sanitary Systems, Inc.
d. Schier Products Company.
e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
f. Tyler Pipe; Wade Div.
g. Watts Drainage Products Inc.

h. Zurn Plumbing Products Group; Specification Drainage Operation.
i. Or approved equal as determined by the Engineer.

2. Type: Factory-fabricated interceptor made for removing and retaining Plaster from wastewater.
3. Body Material: Cast iron or steel.
4. Interior Separation Device: Screens.
5. Interior Lining: Corrosion-resistant enamel.
6. Refer to Specifications on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install fixture air-admittance valves on fixture drain piping.

G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

I. Install deep-seal traps on floor drains and other waste outlets, if indicated.

J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

L. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.

M. Install wood-blocking reinforcement for wall-mounting-type specialties.

N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

O. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counter flashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Solids interceptors.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories, bathtubs, bathtub/showers, showers, and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Urinals.
8. Lavatories.
9. Bathtubs.
10. Individual showers.
11. Kitchen sinks.
12. Service basins.

B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
3. Division 22 Section “Water Coolers.”

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and

tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass-reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Plastic Mop-Service Basins: ANSI Z124.6.
3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
4. Slip-Resistant Bathing Surfaces: ASTM F 462.
5. Stainless-Steel Residential Sinks: ASME A112.19.3.
6. Vitreous-China Fixtures: ASME A112.19.2M.
7. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
2. Faucets: ASME A112.18.1.
3. Hose-Connection Vacuum Breakers: ASSE 1011.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
6. NSF Potable-Water Materials: NSF 61.
7. Pipe Threads: ASME B1.20.1.
8. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
9. Supply Fittings: ASME A112.18.1.
10. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for bathtub bathtub/shower and shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
4. Faucets: ASME A112.18.1.
5. Hand-Held Showers: ASSE 1014.
6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Manual-Control Antiscald Faucets: ASTM F 444.
9. Pipe Threads: ASME B1.20.1.
10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Manual-Operation Flushometers: ASSE 1037.
4. Plastic Tubular Fittings: ASTM F 409.
5. Brass Waste Fittings: ASME A112.18.2.
6. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Floor Drains: ASME A112.6.3.
2. Grab Bars: ASTM F 446.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Off-Floor Fixture Supports: ASME A112.6.1M.
5. Pipe Threads: ASME B1.20.1.
6. Plastic Toilet Seats: ANSI Z124.5.
7. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of unit shell.
b. Faulty operation of controls, blowers, pumps, heaters, and timers.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period for Commercial Applications: One year(s) from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.
4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
5. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. American Standard Companies, Inc.
b. Chicago Faucets.
c. Delta Faucet Company.
d. Kohler Co.
e. Or approved equal as determined by the Engineer.

2. Description: Refer to Schedule on Drawings.

2.2 BATHTUB FAUCETS

A. Bathtub Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. American Standard Companies, Inc.
b. Delta Faucet Company.
c. Kohler Co.
d. Symmons Industries, Inc.
e. Pegler, Ltd.
f. Or approved equal as determined by the Engineer.

2. Description: Refer to Schedule on Drawings.

2.3 BATHTUB/SHOWER FAUCETS

A. Bathtub/Shower Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. American Standard Companies, Inc.
b. Chicago Faucets.
c. Delta Faucet Company.
d. Kohler Co.
e. Symmons Industries, Inc.
f. Or approved equal as determined by the Engineer.

2. Description: Refer to Schedule on Drawings.

2.4 SHOWER FAUCETS

A. Shower Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. American Standard Companies, Inc.
b. Chicago Faucets.
c. Delta Faucet Company.
d. Kohler Co.
e. Leonard Valve Company.
f. Or approved equal as determined by the Engineer.

2. Description: Refer to schedule on Drawings.

2.5 SINK FAUCETS

A. Sink Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. American Standard Companies, Inc.
   b. Chicago Faucets.
   c. Delta Faucet Company.
   d. Kohler Co.
   e. Or approved equal as determined by the Engineer.

2. Description: Refer to schedule on Drawings.

2.6 FLUSHOMETERS

A. Flushometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. Sloan Valve Company.
   b. Zurn Plumbing Products Group; Commercial Brass Operation.
   c. Coyne & Delany Co.
   d. Or approved equal as determined by the Engineer.

2. Description: Refer to schedule on Drawings.

2.7 TOILET SEATS

A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. American Standard Companies, Inc.
   b. Bemis Manufacturing Company.
   c. Centoco Manufacturing Corp.
   d. Church Seats.
   e. Kohler Co.
   f. Olsonite Corp.
   g. Or approved equal as determined by the Engineer.

2. Description: Toilet seat for water-closet-type fixture.

   a. Material: Molded, solid plastic with antimicrobial agent.
   b. Configuration: Open front with cover.
   c. Size: Elongated.
   d. Hinge Type: SC, self-sustaining, check.
   e. Class: Standard commercial.

f. Color: White.

2.8 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Engineered Brass Co.
   b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
   c. Plumberex Specialty Products Inc.
   d. TCI Products.
   e. TRUEBRO, Inc.
   f. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
   g. Or approved equal as determined by the Engineer.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot and cold water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements. Conform to ASTM E84.

2.9 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.
7. Or approved equal as determined by the Engineer.

B. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

C. Lavatory Supports:

1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.10 WATER CLOSETS

A. Water Closets,(Dual flush, 1.6/1.1 gpf):

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. American Standard Companies, Inc.
    b. Kohler Co.
    c. Zurn.
    d. Or approved equal as determined by the Engineer.

2. Description: Accessible, floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.

    a. Refer to schedule on Drawings.

2.11 **URINALS**

A. Urinals,(Low flow, 0.125 gpf):

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. American Standard Companies, Inc.
    b. Kohler Co.
    c. Zurn.
    d. Or approved equal as determined by the Engineer.

2. Description: Accessible, wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.

    a. Refer to Schedule on Drawings.

2.12 LAVATORIES

A. Lavatories (Low flow, 0.5 gpm):

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. American Standard Companies, Inc.
    b. Kohler Co.
    c. Or approved equal as determined by the Engineer.

2. Description: Accessible, wall-mounting, vitreous-china fixture.

    a. Refer to Schedule on Drawings.

B. Lavatories (Low flow, 0.5 gpm):

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Kohler Co.
    b. American Standard Companies, Inc.

c. Or approved equal as determined by the Engineer.

2. Description: Counter-mounting, vitreous-china fixture.

a. Refer to schedule on Drawings.

2.13 **BATHTUBS**

A. Bathtubs:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Kohler Co.
b. American Standard Companies, Inc.
c. Crane Plumbing, L.L.C./Fiat Products.
d. Or approved equal as determined by the Engineer.

2. Description: Enameled, cast-iron fixture.

a. Refer to schedule on Drawings.

2.14 INDIVIDUAL SHOWERS

A. Individual Showers (Low flow, 1.6 gpm):

1. Description: Components for built-up shower.

a. Refer to schedule on Drawings.

2.15 KITCHEN SINKS

A. Kitchen Sinks (Low flow, 1.5 gpm):

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Eljer.
b. Elkay Manufacturing Co.
c. Dayton Products, Inc.
d. Just Manufacturing Company.
e. Or approved equal as determined by the Engineer.

2. Description: Two-bowl, residential, counter-mounting, stainless-steel kitchen sink.

a. Refer to schedule on Drawings.

2.16 SERVICE BASINS

A. Service Basins:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Acorn Engineering Company.
    b. Crane Plumbing, L.L.C./Fiat Products.
    c. Florestone Products Co., Inc.
    d. Precast Terrazzo Enterprises, Inc.
    e. Or approved equal as determined by the Engineer.

2. Description: Flush-to-wall, floor-mounting, cast-polymer fixture with rim guard.

    a. Refer to schedule on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

    1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
    2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
    3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

L. Install toilet seats on water closets.

M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install shower flow-control fittings with specified maximum flow rates in shower arms.

Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

S. Set bathtubs and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

T. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

D. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

SECTION 26 01 00
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. This section expands and supplements requirements specified in Division 01.

B. Related Sections include the following:

1. Division 01 in its entirety.

1.2 SUMMARY

A. This Section includes the following:

1. Abbreviations.
2. Allowances.
3. Alternates.
4. Closeout Documentation.
5. Codes, Permits & Inspections, and Labeling.
6. Color Selections.
7. Contractor Qualifications.
8. Coordination Drawings.
9. Definitions.
10. Deliveries.
11. Discrepancies.
12. Electronic Media.
13. Job Site Safety
14. Job Site Security
15. Keys.
16. LEED-Sustainable strategies equivalent to a Silver Certification. It is to be noted that this is not a LEED certified project.
17. Operating and Maintenance Manuals.
18. Pre-Bid Meeting.
19. Record Documents and As-Built Drawings.
20. Requests For Information.
21. Shop Drawings.
22. Spare Parts.
23. Training.
24. Warranties.

1.3 ABBREVIATIONS

A. The following is a list of abbreviations that may be found in either the specifications or drawings, including subscripts to equipment connections or junction boxes:

1. A: Ampere, Ammeter
2. AC: Alternating Current

3. ACC: Air Cooled Chiller
4. ACCU: Air Cooled Condensing Unit
5. ADA: Americans with Disabilities Act
6. ADO: Automatic Door Operator
7. AF: Ampere Frame
8. AFC: Above Finished Ceiling
9. AFF: Above Finished Floor
10. AFG: Above Finished Grade
11. AHJ: Authorities Having Jurisdiction
12. AHU: Air Handling Unit
13. AIC: Amperes Interrupting Capacity
14. AL: Aluminum
15. ALT: Alternate
16. ANSI: American National Standards Institute
17. ARCH: Architect or Architectural
18. ASI: Architect’s Supplemental Instruction
19. ASSCP: Auditorium Sound System Control Panel or Rack
20. AT: Ampere Trip
21. ATC: Acoustical Tile Ceiling
22. ATS: Acceptance Testing Specifications or Automatic Transfer Switch
23. AWG: American Wire Gauge
24. BFC: Below Finished Ceiling
25. BFF: Below Finished Floor
26. BFG: Below Finished Grade
27. BL: Bed Locator
28. C: Conduit
29. CATV: Cable Television
30. CCD: Construction Change Directive
31. CCTV: Closed Circuit Television
32. CCTVCP: Closed Circuit Television Control Panel or Rack
33. CD: CanDela
34. CLG: (above or flush with) Ceiling (as necessary)
35. CM: Coffee Machine or Coffee Maker or Construction Manager
36. CO: Certificate of Occupancy or Change Order
37. CON: Contactor
38. CP: Control Panel or Courtesy Phone
39. CSBA: Color Selected By Architect
40. CU: Copper
41. D: Data
42. DC: Direct Current or Door Contact
43. DDC: Direct Digital Controls
44. DFS: (North Carolina) Division of Facility Services
45. DHEC: (South Carolina) Department of Health and Environmental Control
46. DISC: Disconnect (aka Safety Switch)
47. DIST: Distribution
48. DOI: (North Carolina) Department Of Insurance
49. DOL: Department Of Labor
50. DP: Distribution Panel
51. DW: DishWasher
52. EA: Each
53. EC: Electrical Contractor
54. EE: Electrical Engineer
55. EF: Exhaust Fan
56. ES: Electric door Strike
57. ELEV: Elevator (controller)
58. ELEVCL: Elevator Cab Lights

59. EM/EMER: Emergency
60. EMT: Electrical Metallic Tubing
61. EPDM: Ethylene-Propylene-Dieneter polymer rubber Membrane.
62. EWC: Electric Water Cooler
63. EWH: Electrical Wall Heater
64. EP: Explosion Proof
65. EX: Existing (to remain)
66. F: Fixed or Fuse or Fiber
67. FA/FA: Fire Alarm
68. FAAP: Fire Alarm Annunciator Panel
69. FACP: Fire Alarm Control Panel
70. FB: Floor Box or Furnished By
71. FBO: Furnished By Others
72. FH: Fume Hood
73. FLA: Full Load Amps
74. FP: Fire Pump
75. FPC: Fire Protection Contractor
76. FPE: Fire Protection Engineer
77. FSS: Fused Safety Switch
78. FX: Flexible (conduit)
79. G,GND: Ground
80. GC: General Contractor
81. GD: Garbage Disposal
82. GF/GFI: Ground Fault Circuit Interrupter (GFCI)
83. GRAP: Generator Remote Annunciator Panel
84. GRC: Galvanized Rigid Conduit
85. GSSCP: Gymnasium Sound System Control Panel
86. GYP: Gypsum board
87. HH: Hand Hole
88. HP: Horsepower
89. HW: Headwall
90. HZ: Hertz
91. IB: Installed By
92. IBO: Installed By Others
93. ID: Inner Duct or Internal Diameter
94. IDF: Intermediate Distribution Frame
95. IG: Isolated Ground
96. IW: In Wall
97. II,III,IV,V: Lighting reflector distribution types as shown next to fixture symbol
98. IM: Ice Machine or Ice Maker
99. JB: Junction Box
100. JBOX: Junction Box
101. JP: Jockey Pump
102. K: One thousand or Keyed
103. KAIC: Amperes Interrupting Capacity (in Thousands)
104. KVA: Kilovolt-Amperes
105. KW: Kilowatts
106. LC: Lighting Contactor or Load Center
107. LCD: Liquid Crystal Display
108. LED: Light Emitting Diodes
109. LTG: Lighting
110. LPI: Lightning Protection Institute
111. LV: Low Voltage
112. MC: Mechanical Contractor
113. MCB: Main Circuit Breaker
114. MCC: Motor Control Center

115. MD: Motorized Door or Motion Detector
116. MDF: Main Distribution Frame
117. ME: Mechanical Engineer
118. MGA: Medical Gas Outlet
119. MH: ManHole
120. MIC: MICrowave or MICrophone
121. MLO: Main Lugs Only
122. MPS: Motorized Projection Screen
123. N/A: Not Applicable
124. NC: North Carolina or Nurse Call
125. NCCL: Nurse Call Central Logic
126. NCCP: Nurse Call Control Panel
127. NCTC: Nurse Call Terminal Cabinet
128. NEC: National Electrical Code
129. NECA: National Electrical Contractors Association
130. NEMA: National Electrical Manufacturers Association
131. NF: Non Fused
132. NFPA: National Fire Protection Association
133. NFSS: Non Fused Safety Switch
134. NIC: Not In Contract
135. NL: Night Light
136. NTS: Not To Scale
137. O&M: Operation and Maintenance (manuals)
138. OAH: Over All Height
139. OD: Outside Diameter
140. OH: OverHead
141. OHP: OverHead Projector
142. OS: Occupancy Sensor
143. OSHA: Occupational Safety and Health Administration
144. P: Pole, Phase or Pan
145. PAN/PNL: Panelboard
146. PC: Plumbing Contractor
147. PE: Professional Engineer or Plumbing Engineer
148. PIT: (Elevator) Pit
149. PIV: Post Indicator Valve
150. POS: Point Of Service
151. PR: Pair or Proposal Request
152. PROVIDE: Furnish, Install & Connect
153. PS: Plasma Screen
154. PT: Poke Through Assembly or Pan-Tilt
155. PTZ: Pan-Tilt-Zoom
156. PVC: Polyvinyl Chloride (Conduit)
157. REF: Refrigerator
158. RFI: Request For Information
159. RFP: Request For Proposal
160. RI: Rough-In
161. RIO: Rough-In-Only
162. RLA: Running Load Amperes
163. RTU: Roof Top Unit
164. SC: South Carolina
165. SCE&G: South Carolina Electric & Gas
166. SCO: (North Carolina) State Construction Office
167. SCP: Security Control Panel
168. SEC: Security (Junction Box or Door Connection)
169. SN: Solid Neutral
170. SPD: Surge Protection Device (aka TVSS)
171. SSCP: Sound System Control Panel

172. ST: Shunt Trip
173. SW: Switch
174. SWBD: Switchboard
175. TBB: Telephone Back Board
176. T: Transformer
177. TC: Temperature Controls or Trophy Case
178. TCC: Temperature Controls Contractor
179. TOS: Top of (Elevator) Shaft
180. TYP: Typical
181. TV: Television
182. TVSS: Transient Voltage Surge Suppression
183. UCREF: Undercounter Refrigerator
184. UG: Underground
185. UH: Unit Heater
186. UL: Underwriter’s Laboratories
187. UNO: Unless Noted Otherwise
188. UON: Unless Otherwise Noted
189. UPS: Uninterruptible Power Supply
190. V: Volt or Voice
191. W/: With
192. WG: Wire Guard
193. WP: WeatherProof
194. WT: Wireless Transmitter
195. XFMR: Transformer

1.3 ALLOWANCES

A. Refer to the Lighting Fixture Schedule on the Drawings for details on the electrical allowance items to include in the bid. It is noted that these are contractor net pricing level material allowances and do not include any necessary taxes or shipping.

1.4 ALTERNATES

A. Refer to Section 010000 “Alternates” for a complete listing and description of each alternate pertaining to work of this Contractor.

1.5 CLOSEOUT DOCUMENTATION

A. Submit in triplicate all of the information listed below at a minimum along with all the requirements stated elsewhere in Division 01 and Division 26/27/28:

1. Operations and Maintenance (O&M) manuals as outlined below in this specification.
2. Certification letter that all electrical equipment has been tested and is operational according to the plans and specifications.
3. Certification letter that all punch list items have been corrected.
4. Certification letter that all clean-up relating to electrical work has been performed.
5. Certification letter that no asbestos or any materials containing asbestos have been used in the electrical portion of the work.

6. Contractor’s notarized affidavit of payment of debts and claims.
7. Contractor’s notarized affidavit of release of liens.

1.6 CODES, PERMITS & INSPECTIONS, AND LABELING

A. E.C. shall be responsible for contacting the VAMC Salisbury Engineering Office for scheduling all required tests and inspections.

B. All work shall be performed in accordance with the NEC and applicable federal, state, county, and city codes and requirements by the Local Authority Having Jurisdiction.

C. Both the Contractor and installing electrician are reminded that since the NEC is by statutory inclusion a part of the laws of the state, they bear a prime responsibility to comply with it even when the plans or specifications denote an apparent violation. This should be observed carefully and continuously, particularly during estimating for proposal, and any discrepancies should be brought to the attention of the engineer for resolution.

D. Contractor shall include in his/her bid all costs for building permits, inspections, and prepays including utility fees unless otherwise noted herein or in Division 01.

E. Contractor shall coordinate and schedule all required State, County, City, and Engineer inspections in a timely manner so as to not “cover up” work to be inspected and to not “hold up” work to be performed by other trades.

F. All electrical equipment, materials, devices, and appliances shall be UL or ETL labeled. All materials must be manufactured in the USA.

G. Anticipated inspections made by the design engineer:

1. Underground – Contractor to notify Engineer 48 hours prior to backfilling typical trenches and pouring of concrete floors for potential inspections. In the event that the Engineer cannot make it to the job site, the Contractor shall take photographs of typical underground rough-in sections, transformer/generator pad foundation, light pole bases, etc. prior to concealing the work for the Engineer’s review.
2. Overhead/In-Wall – Contractor to notify engineer one week prior to installing gypsum board walls/ceilings and acoustical lay-in ceilings and while typical masonry wall rough-in work is being performed for potential inspections. At this time, the following list below shall be ready for the engineer to review. If this phase of the project in given major areas of the building are not complete at this time, engineer reserves the right to be compensated for additional site visits to complete the OH/IW rough-in inspection if necessary.

    a. All raceways, cable tray, fittings, supports, boxes, junction box covers, etc. must be complete.
    b. All power and low voltage wiring must be complete.

3. Final – Contractor to notify engineer one week prior to need for potential final inspections. At this time, the following list below shall be ready for the engineer to review. If project is not complete at this time, engineer reserves the right to be compensated for additional site visits to complete the final inspection if necessary.

   a. Electrical Contractor's own punchlist of outstanding items.
   b. Panelboard covers removed or have pictures taken for Engineer's review.
   c. Transformer enclosures removed or have pictures taken for Engineer's review.
   d. All circuits energized for testing.
   e. All receptacles, switches, lights, equipment, and low voltage systems devices shall be installed, operational, and tested.
   f. Service and transformer grounding connections exposed or have pictures taken for Engineer's review.
   g. All low voltage systems checkout and testing reports by the respective manufacturers.
   h. One receptacle, one light switch outlet box, and one homerun junction box to be open for review, upon request.
   i. Ladder for engineer's use.

H. After site observations are made, the Engineer will provide field reports and generate deficiency logs to the Contractor through the Architect. These items are to be addressed by the Contractor to the Architect within (14) days of receipt, unless otherwise agreed upon in writing. When the items are corrected, the items shall be initialed and dated by the electrical "foreman" and not by the electrical "project manager."

1.7 COLOR SELECTIONS

A. All electrical equipment involving a color selection shall be brought to the attention of the Architect, via a shop drawing submittal, for their direction. Contractor shall provide the Architect with a list full range of colors that can be selected from. Contractor shall provide color chips, samples, color brochures, etc. for the Architect's use.

B. All electrical equipment involving color selection shall be submitted at one time, along with the other finishes for other disciplines needing a color selection so that the Architect has all the information together to make a complete decision.

C. Some examples of electrical equipment needing a color selection are:

   1. Non-emergency power wiring devices and telecom outlets.
   2. Non-emergency power wiring device and telecom outlet cover plates.
   3. Surface raceway.
   4. Fire alarm horn/strobe lights.
   5. Exposed light fixtures in aesthetic areas.
   6. Exterior light fixtures.

7. Floor box or poke through assembly trim plates.

1.8 COMMISSIONING

A. Contractor shall hire an independent Commissioning Agent to certify all the equipment they install and/or connect to. Refer to Specification Section 260200 for further information.

1.9 CONTRACTOR QUALIFICATIONS

A. Contractor shall have been in business for at least five years and have completed at least three projects of similar size and scope.

B. Contractor shall have proper business and employee licenses in order to perform work in the state.

C. Refer to individual specification sections for additional qualifications relevant to each specification section.

D. Contractor to provide sufficient qualified journeyman electricians who are thoroughly experienced with the materials and methods specified and familiar with the design requirement.

E. At least one qualified journeyman, designated as the superintendent, shall be present at all times during the execution of the work.

F. In acceptance or rejection in any portion of the electrical work, no allowance will be made for lack of skill on the part of the workmen.

1.10 COORDINATION DRAWINGS

A. A meeting shall be arranged by the General Contractor and take place prior to the G.C. starting the coordination drawings. This meeting shall include at a minimum the G.C., Architect, Owner’s representative and Engineers such that we can confirm the requirements of the coordination drawings prior to them being submitted.

B. E.C. shall coordinate with the G.C. and other trades so that the following lists of items can be indicated on a common set of plans. Floor plans and sections are to be drawn to scale in all congested areas (such as corridors, chases, and equipment rooms) and specific areas noted in these documents. These shall be submitted collectively from all disciplines into one overall document for review by the Engineer on an as needed basis or where specifically directed within the Contract Documents. These coordination drawings shall be submitted for review prior to any other individual product data or fabrication drawings. Show the following at a minimum:

1. Ceiling.
2. Floor.
3. Roof or floor decking above.
4. Structural elements.

5. Cable tray or J-hook layout.
6. Clearances required for access above and to side of cable trays or j-hooks.
7. Light fixtures.
8. Large electrical or telecom conduits and/or pull boxes.
9. HVAC ductwork.
10. HVAC piping.
11. Plumbing piping.
12. Sprinkler piping.
13. Mounting racks and support assemblies for associated piping/ductwork.

C. It is important to note that ductwork/piping/cable tray, etc. cannot be fabricated, until the coordination drawings have been compiled, submitted, and approved. Any material procurement or installation work commenced prior to approval is taken at the risk of the Contractor and may have to be modified/moved at their cost.

1.11 DEFINITIONS

A. Where the word “provide” is used relating to a system or piece of equipment, it shall be understood to mean the furnishing and installing of the system or equipment.

B. Where the word “furnish” is used relating to a system or piece of equipment, it shall be understood to mean supply to the project only, for installation under other Divisions as part of this contract.

C. Where the word “install” is used relating to a system or piece of equipment, it shall be understood to mean to place and put in service equipment furnished under other Divisions as part of this contract.

D. Where the phrase “as directed” is used, it shall be understood to mean direction given to the Contractor by the Architect, Engineer, or Owner.

E. Where the phrase “as indicated” is used, it shall be understood to mean as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as “shown”, “noted”, “scheduled” and “specified” have the same meaning as “indicated”, and are used to assist the reader in locating particular information.

F. Where the word “Contractor” is used, it shall be understood to mean the contractor responsible for all Division 26 specifications and electrical drawings, unless otherwise noted. For projects where one prime contract is awarded, the Prime Contractor shall be responsible for all Division 26/27/28 work included in these specifications and electrical drawings.

G. Where the term “E.C.” is used, it shall be taken as a guide for the scope normally performed by the Electrical SubContractor, whereas when the term “G.C.” is used, it shall be taken as a guide for the scope normally performed by the General Contractor. For projects

where multiple prime contracts are awarded, the Electrical Contractor shall be responsible for all Division 26 work included in these specifications and electrical drawings.

H. Where the term “switchgear” is used, it shall in general refer to all types of switchgear equipment such as transformers, panelboards, switchboards, load centers, disconnects, motor starters, motor control centers, transfer switches, paralleling gear, medium voltage switching equipment, unit substations, variable frequency drives, etc.

1.12 DELIVERIES

A. All deliveries for equipment ordered by the Contractor shall be accommodated by the Contractor. Contractor shall coordinate deliveries and storage space for equipment during hours that the Contractor is on site. The Owner will not be responsible for receiving/unloading equipment whether during working hours or after hours, unless otherwise closely coordinated up front with the Owner. Contractor shall also provide their own means of unloading equipment.

1.13 DISCREPANCIES

A. Should it appear that there is a discrepancy between or within the Division 26/27/28 drawings, and/or Division 26/27/28 specifications, and/or the local Authority Having Jurisdiction’s interpretations, and/or local Utility Companies regulations concerning the nature, quality or extent of materials or work to be furnished and/or installed, and such discrepancy is not brought to the Architect/Engineer’s attention during Bidding for a formal written Addendum clarification, this Contractor shall base his/her bid on performing the work in the manner having the higher cost or more stringent option. The Architect/Engineer shall then have the option during construction of selecting either of the manners shown and/or specified at no additional cost to the Owner. In the event the lower cost manner is selected, a credit shall be due the Owner in the amount of the difference between the lower cost and higher cost manner. All discrepancies shall be called to the attention of the Architect before proceeding with work affected thereby.

B. This specification section is not meant to contradict other specification sections that describe similar scopes of work. The intent of this section is to clarify any basic issues that may have been omitted in other Divisions or are not entirely clear as to how they affect the Contractor(s) of this Division.

C. Should it appear that there is a discrepancy between the Division 26 drawings and/or specifications with other Division drawings and/or specifications, and such discrepancy is not brought to the Architect/Engineer’s attention during Bidding for a formal written Addendum clarification, this Contractor shall base his/her bid on performing the work in the manner having the higher cost or more stringent option. The Architect/Engineer shall then have the option during construction of selecting either of the manners shown and/or specified at no additional cost to the Owner. In the event the

lower cost manner is selected, a credit shall be due the Owner in the amount of the difference between the lower cost and higher cost manner. All discrepancies shall be called to the attention of the Architect before proceeding with work affected thereby.

D. The design drawings, as submitted, are diagrammatic and are not intended to show exact location of equipment, light poles, utility poles, electrical devices above and below counters, floor boxes, poke-throughs, power poles, wall mounted lights, television outlets and receptacles, etc. unless dimensions are given. Drawings are not to be scaled. Verify all exact locations with Architect prior to rough-in. Verify mounting heights of all surface raceways in finished areas and heights of wiring devices above or below casework with the Architect prior to rough-in.

1. Equipment shall be installed along the general arrangement indicated on the drawings, and in accordance with the manufacturer's instructions.

   a. Provide at least the minimum manufacturers recommended and code required clearance around the equipment for normal maintenance.
   b. Locate and arrange equipment in relationship to other system components to assure that the equipment will be operating under the best possible conditions to meet the scheduled performance requirements.

2. Raceways are to be installed along the general plans shown on the drawings keeping in mind the constraints of the available space and the need to coordinate with the work of other trades. Additional bends, pull and splice boxes shall be provided as necessary to meet space constraints and to facilitate the work of other trades.

E. Electrical equipment, specified hereinafter as shown on the drawings shall be furnished and installed by this Contractor, unless specifically indicated to the contrary.

F. Occasionally, certain references may be indicated on the Drawings to items which are suggested to be furnished and/or installed by various subcontractors. This is done to assist the applicable Prime Contractor in organizing his subcontractor's bids. However, no attempt has been made, nor is it implied, that this specification or plans are attempting to specifically divide all responsibilities for subcontractors. It is the Prime Contractor's responsibility that all items covered on electrical plans and Division 26/27/28 specifications are included in his bid and are coordinated with his subcontractors. No consideration will be given for Prime Contractor's failure to include all applicable electrical work in his bid.

G. Where more than one manufacturer is named for major items of equipment, the manufacturer noted on the Drawings has been used as a basis for design. If another manufacturer is used, other than the one named on the Drawings, it shall be the responsibility of this contractor to ensure that the equipment will fit the space

with all legal clearances, or bear the expense to change the space and structure to accommodate equipment used.

1.14 ELECTRONIC MEDIA

A. Where the Contractor is required to produce full size drawings for shop drawings, as-builts, or to outline the work involved for his/her use (i.e. fire alarm, lightning protection, voice/data, point-by-point lighting calculations, etc.), the electronic drawings can be obtained from the Government. The file type will be coordinated with the Government.

1.15 JOB SITE SAFETY

A. The Contractor and not the Engineer is responsible for all job site safety relating to his or her work. The Contractor shall be familiar with all safety requirements, such as OSHA regulations, and comply accordingly. The Contractor shall coordinate providing of all personal protection equipment with their employees.

1.16 JOB SITE SECURITY

A. The Contractor shall be responsible for all security of their employees, materials, tools, and equipment. Contractor shall lock up and store materials, tools, and equipment accordingly.

1.17 KEYS

A. During construction, this Contractor shall keep the keys for any and all electrical cabinets, panelboards, lockable covers, manual pull stations, keyed switches, etc. As part of the closeout procedures, this Contractor shall turn over to the Owner six identical key rings with a full set of spare keys on each. Each key shall be labeled with its corresponding designation on a hand written or machine printed label. If six keys of each type do not come with the equipment for the project, have the manufacturer produce additional keys to fill the set.

1.18 OPERATING AND MAINTENANCE MANUALS

A. As part of closeout procedures the Contractor shall turn over to the Architect/Engineer for approval a minimum of three (3) copies of operation and maintenance manuals. Refer to Division 01 for quantity of O&M manuals that may exceed the minimum three. The approved manuals shall then be turned over to the Owner, upon review of the Architect/Engineer. These O&M manuals shall consist of 3-ring binders with loose leaf information, permanent covers, clearly identified and indexed with table of contents, tabs for each section, containing the following at a minimum:

1. Complete list of personnel and contact info for any related warranty work.
2. Complete description of the automatic operation, manual operation, and safety features built into the system.
3. Step-by-step procedures for start-up, operation, and shut-down for each system and piece of equipment.

4. Complete list of diagnostic and troubleshooting procedures for systems and major equipment.
5. Recommended preventative maintenance program for each piece of mechanical equipment, and each system, including items to be inspected and serviced, frequency of inspection and servicing, the type of servicing required, and types of lubricants to be used.
6. As-built material list including make and model numbers.
7. Catalog brochures for all components with specific parts used, marked clearly.
8. Supplier’s and manufacturer’s conformance of specifications and drawings certificates.
9. Copy of all test reports by manufacturer and contractor.
10. Performance data, curves, ratings.
11. Dimensional drawings.
12. Wiring and block diagrams, indicating factory wiring separate from field wiring.
13. Required settings.
14. Manufacturer's descriptive literature.
15. Manufacturer's maintenance and service manuals.
16. Multiple copies of Manufacturer’s **original** installation and maintenance manual that comes with the equipment itself.
17. Spare parts bill of material.
18. Owner’s sign off sheets for receipt of spare parts and training.
19. Name of service agency and installer complete with an emergency service phone number for nights, weekends and holidays.
20. Final approved shop drawings.
21. Warranties and guarantees.
22. Copies of all inspection reports and checkout forms by AHJs, inspectors, utilities, manufacturers, NFPA 72 Record of Compliance Form, etc.
23. Owner’s training video tapes, if applicable.
24. Any other pertinent information that the Contractor or Manufacturer feels is important for the Owner to know about the electrical equipment or system.

1.19 PRE-BID MEETING

A. All persons wishing to submit quotations for work in accordance with these plans and specifications are strongly urged to attend the pre-bid meeting for further insight into the project.

1.20 RECORD DOCUMENTS AND AS-BUILT DRAWINGS

A. The Contractor shall maintain on site at all times a dedicated space for a current set of red-lined as-built specifications and drawings to record revisions to the original set of construction documents. These revisions shall include, but are not limited to: major interior conduit routings, all exterior underground raceways, manholes, and handholes, all Architect’s Supplemental Instructions, all Bulletin drawings, all Addenda descriptions and drawings, all Change Orders, all Construction Change Directives, all Contractor field revisions such as circuiting changes, etc.

B. The Engineer or Owner may at any time ask to review the as-built drawings and specifications during construction.

C. These as-built plans and specifications shall be in addition to the sets used by the installing electricians in carrying out their day to day work on the project. The projected location of every outlet, raceway, or item of equipment to be installed under this contract shall be checked against the plans and specifications of all the other trades as well as by daily conference with workmen and supervisors of all other trades to the extent that any conflicts or uncertainties about locations are resolved before work is installed, particularly sprinkler head locations, etc. ceiling construction installation shall be made in accord with reflected ceiling plans and/or instructions by the Architect's representatives on the site. Moving of items from locations shown, rerouting, or changes to accomplish any work as shown on plans or specifications in order to accomplish this coordination shall not be a cause for claim for additional compensation for the work.

D. As part of the closeout procedures, the Contractor shall take a clean set of drawings and produce one set of as-built specifications and drawings in red ink with a signed Record Drawing stamp. These drawings are to be turned over to the Engineer for his/her use in producing electronic drawings referred to as Record Documents.

1.21 REQUESTS FOR INFORMATION

A. When a question, clarification, or discrepancy arises after the Bid has been awarded, the Contractor shall submit in writing to the Architect an RFI to document the issue. The RFI must indicate the drawings and/or specification sections being referenced and eluded to. Upon receipt, the Engineer will then respond back to the RFI in writing as soon as possible given the circumstances of the RFI. Contractor shall take proper measures to initiate RFI in a timely fashion in order for the Engineer to properly evaluate.

1.22 SHOP DRAWINGS

A. Within 30 calendar days following Contract approval or Notice To Proceed and prior to submitting shop drawings, this Contractor shall submit to the Engineer a list of proposed manufacturers and (sub) Contractors for each specification section and each major piece of equipment for approval. Along with the above information, Contractor to submit the Pay Application Schedule Of Values and a Shop Drawing Submittal Schedule to the Engineer for their review coordination.

B. All shop drawings shall be submitted to the Architect for review within 60 days of receiving a contract, so as not to delay the project.

C. This Contractor shall review, stamp and sign with his/her approval and submit in an orderly sequence so as to cause no delay in the work or in the work of any other Contractor, all submittal information and samples required by the contract documents. Submittal information not stamped with Contractor approval will be returned for reprocessing.

D. Contractor shall **not** begin fabrication or rough-in work or release of materials until return of submittals with Engineer's approval. This is especially important for rough-in items below slab (such as switchgear and floor boxes) and inside poured walls (such as recessed light fixture rough-in boxes).

E. In approving the submittals, the Contractor guarantees that the submittals accurately and completely represent the equipment and materials to be installed.

F. Shop drawings shall be submitted for ALL material items as outlined in these specifications. Any deviations from contract requirements must be clearly indicated on shop drawings, and justification for their consideration must be included.

G. Acceptance of submittal items will not preclude rejection of those items upon later discovery that their suitability for the application or ability to meet the requirements of these specifications was misrepresented in the submittals.

H. Submittals for equipment shall include detailed dimensional drawings which completely and accurately represent the specific piece of equipment to be supplied and all required clearances. When more than one piece of similar equipment is to be supplied, provide accurate dimensional drawings for each unique size and/or configuration of the equipment.

I. In checking shop drawings, the Engineer will make every effort to detect and correct errors, omissions and inaccuracies in such drawings, but his/her failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for the proper and complete installation in accordance with the intent of the Contract Documents.

J. The shop drawings will be reviewed by the Engineer per specification section. The Contractor shall bind together multiple specification section shop drawings if they so desire, however a separate shop drawing review sheet shall be issued for each section. This will help identify the issues involved with each item, rather than accepting or rejecting the entire submittal as a whole. However, a single specification section shop drawing shall not be broken out and submitted as partial shop drawings as the entire shop drawing for that specification section must be submitted together. If the Contractor submits multiple copies of partial shop drawings, they will not be reviewed by the Engineer and will be sent back as rejected.

K. In the event of multiple shop drawing (re)submissions for the same equipment or specification section, the Engineer reserves the right to require additional fee for a third review of the same shop drawing if the Contractor continues to not adhere to the shop drawing requirements listed in the specifications and the Engineer’s prior review comments.

L. Contractor shall maintain at the site a complete set of all shop drawings, fixture and equipment cut sheets, manufacturer’s wiring

diagrams, and installation data. Installing personnel shall study this data before and during installation and rough-in so as to prepare for the proper fit and function upon completion.

M. Coordinate the quantity of shop drawings to be submitted with Architect at the outset of the project, ensuring that the Engineer can retain at least one copy for his/her records.

N. The shop drawings shall indicate factory wiring separate from field wiring.

O. The shop drawings need to illustrate all required rough-in box sizes.

P. The Engineer will perform due diligence in reviewing shop drawings as quickly as they are received. However, if the majority of the shop drawings are received at the same time, the Contractor shall provide the Engineer with a priority list for their use in reviewing the shop drawings in that order to best expedite the project.

Q. Contractors options:

1. For products specified only by reference standard, Contractor shall select any product meeting that standard.
2. For products specified by naming several manufacturers or manufacturer’s make and model numbers, select any one of the products or manufacturers named. Be aware that just because a manufacturer is listed does not guarantee that they comply with all of the specifications. The manufacturer still has to illustrate through shop drawings that they meet all the required criteria in the specifications prior to approval.
3. For products specified by naming one or more products or manufacturers and "or equal", Contractor must submit a request for substitutions for any product or manufacturer not specifically named during the Bidding process for formal pre-approval.

1.23 SPARE PARTS

A. Refer to individual specification sections for quantity and description of required spare parts.

B. Label each box of spare parts clearly identifying the contents and turn over to Owner. Prepare a bill of material for all spare parts and have Owner sign off receiving the inventory. Include the spare parts sign off sheet as part of the closeout documents.

1.24 TRAINING

A. Refer to individual specification sections for quantity and description of required Owner’s Training.

B. Contact and schedule with the Owner two weeks ahead of time for all training. Stress to the Owner to have any and all relevant

personnel, teaching staff, and maintenance staff available for the training.

C. Personnel conducting training shall be: trained and experienced in maintenance and operation of equipment, familiar with specification requirements, skilled as a technical writer to the extent required to communicate essential data, and skilled as a draftsperson competent to prepare required drawings.

D. Distribute and review operations and maintenance manuals, shop drawings, record drawings, warranties, spare parts, keys, etc. at that time. Provide hands on demonstration of equipment operation, maintenance, troubleshooting, and features. Review spare parts inventory and contact information for future maintenance. Prepare a written sign off sheet for all attendees to sign having witnessed the training. Include the training sign off sheet as part of the closeout documents. Videotape all training and provide videotape to Owner as part of the closeout procedure.

1.25 WARRANTIES

A. Refer to individual specification sections for quantity and description of required Warranties.

B. Prepare and deliver to the Owner all formal written certificates of warranty clearly stating the scope of the warranty and time period.

C. All warranties to commence at the time of Substantial Completion regardless of startup time or turnover to the Owner. Provide monies in the bid as required to accommodate the start of this warranty period.

D. All equipment under this Division of work shall be warranted for a minimum of one year or manufacturer’s minimum warranty whichever is greater, unless otherwise noted. During this warranty period, the Contractor shall replace any and all defective equipment and parts at no additional cost to the Owner.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 26 01 00

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Section 260533 "Raceways and Boxes for Electrical Systems” for work relating to sleeves.
2. Section 260536 “Cable Trays for Electrical Systems” for work relating to sleeves.

1.2 SUMMARY

A. This Section includes the following:

1. Access doors.
2. Cleanup.
3. Concrete.
4. Cutting and patching.
5. Damages.
6. Delivery, storage, and handling.
7. Demolition.
8. Electrical equipment coordination and installation.
9. Equipment wiring and equipment diagrams, details, and risers.
10. Excavation, backfill, and compaction.
11. Fire stopping.
12. Grading and planting.
13. Intent of drawings and specifications.
14. Interruption of existing electrical services.
15. Lug ratings.
16. Painting and caulking.
17. Phasing.
18. Renovation projects.
19. Rough-in.
20. Site visits.
21. Sleeves for above grade raceways and cables.
22. Temporary protection of electrical equipment.
23. Temporary power and lighting.
24. Temporary power usage fees.

1.3 SUBMITTALS

A. Product Data: Access panels of each type, sleeves of each type, and fire stopping as indicated below:

1. Shop drawings shall indicate proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction.

2. Provide a copy of each UL illustration of each proposed system indicating manufacturer approved modifications.
3. Provide manufacturer’s specifications, recommendations, installation instructions and maintenance instructions.

1.4 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 ACCESS PANELS

A. Manufacturers:

1. Bar-Co, Inc.
2. J.L. Industries.
3. Karp Associates, Inc.
4. Larsens Manufacturing Company.
5. Mifab Manufacturing Company.
6. Milcor Div., Inryco. Inc.
7. Nystrom Building Products.
8. Or approved equal as determined by the Engineer.

B. Coordinate keying, color, and type with Architect to match all other trades.

C. Unless specified differently by Architect, provide cold rolled steel door and frame, continuous piano hinged access panels, common mortise keyed cylinder.

D. Provide non-fire rated or fire-rated access doors according to the specific installation requirements.

E. The size of the access panels shall be kept to a bare minimum for required accessibility.

2.3 CONCRETE

A. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I, except as otherwise indicated.
2. Aggregates: ASTM C 33, except as otherwise indicated.

a. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used.
b. For rough grouting, provide aggregate which is well graded and 100 percent passing through 3/8" sieve.

3. Water: Clean and free of substances harmful to concrete.
4. Design Mix: Design electrical work concrete as follows, for each 28-day compressive strength class.

a. 4000 psi Class: 565 lbs. of cement per cu. yd. (6.0 sacks), and 0.35 water/cement ratio.
b. 3000 psi Class: 500 lbs of cement per cu. yd. (5.25 sacks), and 0.46 water/cement ratio.
c. 2500 psi Class: 450 lbs. of cement per cu. yd. (4.75 sacks), and 0.54 water/cement ratio.
d. Mix for Patching: Where electrical work requires patching of exposed concrete work which has been cut to accommodate electrical work, provide concrete patching mix which is identical with mix of work being patched (same cement, aggregates, admixtures and proportioning).

2.4 FIRE STOPPING

A. Fire stopping materials shall be safety barriers designed to block the spread of fire and smoke through penetrations created by electrical installations to fill holes, spaces, and voids in fire rated walls and floors. Products may be in the form of mortar, sealant, caulk, putty, wrap, strip, sheet, or devices. Materials shall be flame, toxic fume and water resistant and shall have a UL fire rating to match that of the wall or floor being penetrated. Fire rating shall be defined by tests conducted by ASTM, UL or other testing and inspection agencies acceptable to Authorities Having Jurisdiction. Fire stopping materials shall also provide adhesion to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits, and cables.

B. Acceptable Manufacturers:

1. Specified Technologies, Inc. (STI)
2. Tremco, Inc.
3. 3M Inc.
4. Hilti, Inc.
5. Nelson Firestop Products.
6. Wiremold.
7. Or approved equal as determined by the Engineer.

C. Materials:

1. Firestop Mortar:

a. STI SpecSeal Mortar
b. Tremco TREMstop-M
c. 3M Fire Barrier Mortar
d. Hilti CP 637 Firestop Mortar
e. Or approved equal as determined by the Engineer.

2. Intumescent Fire Stop Sealants and Caulks

   a. STI SpecSeal Mortar
   b. Tremco TREMstop-WBM
   c. 3M Fire Barrier CP-25 WB
   d. Hilti FS-ONE Intumescent Firestop Sealant
   e. Or approved equal as determined by the Engineer.

3. Silicone Fire Stop Sealants Caulks

   a. STI SpecSeal Pensil 100 & 300
   b. Tremco Fyre Sil Sealant
   c. 3M Fire Barrier 2000 & 2003
   d. Hilti CP 601s Elastomeric Firestop Sealant
   e. Or approved equal as determined by the Engineer.

4. Fire stop Putty:

   a. STI SpecSeal Firestop Putty Bars & Pads
   b. Tremco TREMstop FP Flowable Putty
   c. 3M Fire Barrier Firestop Putty
   d. Hilti CP 618 Firestop Putty
   e. Or approved equal as determined by the Engineer.

5. Fire stop Collars:

   a. STI SpecSeal Firestop Collars
   b. Tremco TREMstop D Combustible Pipe Device
   c. 3M Fire Barrier Pipe Device
   d. Hilti CP 642,643(N), or CP644 Firestop Collar
   e. Or approved equal as determined by the Engineer.

6. Wrap Strip:

   a. STI Spec Seal Wrap Strip
   b. Tremco TREMstop-WS
   c. 3M Fire Barrier WS-195 Wrap Strip
   d. Hilti CP 645 or CP 648 Wrap Strip
   e. Or approved equal as determined by the Engineer.

7. Pre-Manufactured 2″ and 4″ Sleeves:

   a. STI EZ Stop.
   b. Wiremold Flamestopper
   c. Or approved equal as determined by the Engineer.

2.5 SLEEVES FOR RACEWAYS AND CABLES

A. Horizontal Through Wall Steel Pipe Sleeves: EMT conduit.

B. Vertical Through Floor Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of

length to suit application. Provide steel lintels where required by Architect to preserve structural integrity of wall.

PART 3 - EXECUTION

3.1 ACCESS PANELS

A. Electrical Contractor shall be responsible for providing all access panels required for his/her work.

B. Coordinate location of access panels and doors for electrical items needing access for service and maintenance, such as junction boxes, pull boxes, duct smoke detectors, etc. that are behind finished surfaces or otherwise concealed.

C. In general, access panels are not normally shown on the electrical drawings as the location of these access panels is a means and methods issue for the Contractor to determine.

D. Notify and coordinate with Architect of each planned access panel prior to installation for their review via coordination drawings. Ordering, fabrication, and installation of all access panels shall not proceed until the coordination drawings have been reviewed by the Architect and Engineer.

E. Coordinate with other Contractors to combine adjacent equipment access from a common access panel to reduce the amount of panels in a given space.

3.2 CLEANUP

A. This Contractor shall be responsible for daily cleanup of all their electrical product debris. This includes but is not limited to: empty cardboard boxes, scrap wire and insulation, scrap conduit, etc.

B. This Contractor shall be responsible for final cleanup and wipe down of electrical items in their scope. These items include but are not limited to: switchboard/panelboard interior tubs, floor boxes, surface switchboard/panelboard covers and tubs, surface mounted raceway, wiring devices, low voltage outlets, low voltage system cabinets and racks, light fixture lenses and louvers, etc.

3.3 CONCRETE

A. This Contractor shall furnish and install concrete foundations or bases under all electrical equipment that rests on floors, concrete encased ductbanks and exterior lighting fixture pole bases. Contractor shall follow drawings and/or manufacturer's literature and/or utility company requirements with regard to design and construction of same.

B. Formwork:

1. General: Design, construct and maintain formwork to support vertical and lateral loads including pressure of cast-in-place concrete. Construct formwork so that formed concrete will be of

required size and shape and in required location. Construct with joints which will not leak cement paste. Form sides and bottoms of concrete work, except where clearly indicated to be cast directly in excavation or against other construction, or on grade or prepared subgrade. Design and construct forms for easy removal without damage to concrete and other work.

a. Install chamfer strips at external corners of exposed concrete work.
b. Construct forms to retain equipment anchor bolts in accurate locations during placement of reinforcing steel and concrete. Use templates furnished by equipment manufacturers to locate anchor bolts or, where not furnished, locate by accurate measure from certified setting diagrams.

C. Placing Reinforcement:

1. General: Comply with requirements and recommendations of specified standards, including "Placing Reinforcing Bars" by CRSI. Place bars where indicated and support to prevent displacement during concrete placement, using appropriate reinforcement supports, properly spaced and wire tied to reinforcing bars.

a. Place reinforcement to obtain at least minimum recommended coverage’s for concrete protection. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which would reduce bond with concrete.

D. Placing Concrete:

1. Wet wooden forms which have been coated with compound, immediately before concrete, and remove excess water from forms.
2. Strength-Class Application: Comply with the following general application requirements.

a. Plain Concrete Encased Ductbanks: Provide 2500 PSI class.
b. Reinforced Concrete Encased Ductbanks: Provide 3000 PS class.
c. Underground Structural Concrete: Provide 3000 PSI class.
d. Concrete Pole Bases: Provide 4000 PSI class.
e. Miscellaneous Supported Work: Provide 3000 PSI class for electrical equipment pads and similar supported work.
f. Concrete Fill: Provide 2500 PSI class for filling structural steel foundation frames and for filling similar large-volume units.
g. Concrete Grout: Provide rough grouting class for filling voids to be grouted which are too small to be filled effectively with 2500 PSI class concrete.
h. Patching General Concrete Work: Match concrete being patched.

3. Deposit concrete continuously or in layers of thickness which will result in no concrete being placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section. If section cannot be placed

continuously, provide construction joints. Deposit concrete as nearly as practicable in its final location, so as to avoid segregation due to rehandling or flowing.

4. Place concrete in ductbanks slowly such that the force of the concrete does not force up the conduits.
5. Red dye shall be applied to the top of freshly placed concrete in all underground duct banks as a warning of electrical hazard in the event of future excavation. This is in addition to the required warning tape.
6. Use only minimal water additive to concrete mixture to allow time to smooth off exposed surfaces.
7. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures complying with recommended practices of ACI 309; eliminate voids in work.
8. Bring horizontal surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps and hollows.
9. Cold Weather Placement: Comply with ACI 306. Do not use frozen materials or materials containing ice and snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. When air temperature has fallen or is expected to fall below 40 deg F (4.4 deg C), heat water and aggregates uniformly before mixing, as required to obtain concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (26.7 deg C), at time of placement. Protect concrete work from physical damage and reduced strength resulting from frost, freezing actions, or low temperatures.
10. Finishing Horizontal Surfaces: Float and trowel horizontal (top) surfaces to level, smooth, uniform textured, dense finish, where surface is to remain exposed or receive coating, membrane or other thin-set finish. Otherwise, leave struck-off surface undisturbed; except scratch surfaces which are to receive concrete or mortar topping.
11. Finishing Concrete Pole Bases: Remove all exposed formwork. "Sonotube" forms for round bases shall be removed to below depth of adjacent paving or grade whichever is applicable. Rub out entire surface of concrete pole base to smooth, uniform texture.
12. Surface Repairs:

    a. Unexposed Surfaces: Repair significantly damaged and honeycombed areas, and remove major projections and fins where forms have been removed.
    b. Exposed Surfaces: On formed surfaces which are to be exposed, including those to be coated or covered with membrane or other thin-set applied finish, repair and patch form-tie holes and damaged and honeycombed areas, filling voids with grout and completely removing fins and other projections.

E. Concrete Curing and Protection:

1. General: Protect freshly placed concrete from drying and excessively cold and hot temperatures, and maintain in moist condition at relatively constant temperature for period of time necessary for hydration of cement, proper hardening, and achievement of strength requirements as specified.

F. Miscellaneous Concrete Work:

1. Concrete Grouting: Space approximately 1" thick between bottom of equipment and top of concrete foundation or base which remains after shimming, shall be filled completely with grouting. Grout shall be made up with sand and cement designed for the purpose which does not shrink on setting up. Exposed surface of grouting shall be finished to make a neat appearance. Grout openings and recesses as indicated, in and around mechanical work and other work which penetrates or adjoins mechanical concrete work, using rough grouting class of concrete mix. Provide formwork where required, and tamp, screed and trowel surfaces. Cure grout as specified for concrete work.
2. Concrete Equipment Pads: In the absence of more specific information, either on drawings, or manufacturer's or utility's literature, the bases shall be level, shall have a minimum height above finished floor/grade of 3-1/2" and extend beyond the base dimensions of the item of equipment (3″ for interior pads and 6″ for exterior pads). Where the terrain is sloped for an outdoor installation, provide additional concrete as required to ensure that each corner of the pad is a minimum of 3-1/2″ above finished grade to prevent water sloping onto the pad from a low corner.
3. Concrete pads placed in existing structures shall be mounted securely to the original substrate with anchor bolts.

3.4 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching of electrical equipment and materials required to:

1. Demolition of electrical items required to be removed from structure to remain.
2. Uncover work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of the Contract Documents.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect or Engineer, uncover and restore work to provide for Architect or Engineer observation of concealed work.

B. Cut, remove, and legally dispose of electrical equipment, components, and materials, including but not limited to electrical items to be removed and items made obsolete by the new work.

C. Protect the structure, furnishings, finishes, and adjacent materials not to be removed.

D. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

E. Where existing construction such as floors, walls, ceilings, etc., must be cut to relocate, remove or add raceways and/or equipment, such construction to be restored to original condition to satisfaction of Architect, by this Contractor using workmen skilled in respective trade.

F. General penetrations through walls, floors, slab, etc. will be patched with materials to match the surrounding surface (i.e. vinyl concrete patch for concrete surfaces, joint and patching compound for dry wall surfaces, etc.). If the penetrated surface is a fire or smoke barrier, refer to "Installation of Fire Stopping Materials" in this section.

3.5 DAMAGES

A. The Contractor will be held responsible for any and all damages to portions of the building caused by it, its employees and subcontractors, including, but not limited to:

1. Damage to any portion of the building caused by the movement of tools, materials, or equipment.
2. Damage to any component of the construction of spaces “turned over” to the Contractor.
3. Damage to the electrical distribution system and/or other space “turned over” to the Contractor.
4. Damage to the electrical, mechanical and/or life safety, or other systems caused by inappropriate operation or connections made by the Contractor or other actions of the Contractor.
5. Other damage to the materials, tools, and/or equipment of the Owner, its consultants, General Contractor, subcontractors, Architect, and other contractors, agents, and leases.

3.6 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment. Coordinate with the Owner for secure storage or equipment and materials or provide secured remote storage.

B. Do not store equipment where conditions fall outside manufacturer’s recommendations for environmental conditions. Secure all sensitive electronic equipment in temperature and humidity controlled areas.

C. Wherever possible, store indoors. Where necessary to store outdoors, store sufficiently above grade and enclose with watertight wrapping.

D. Handle equipment carefully to prevent physical damage to equipment and components. Remove packaging, including the opening of crates and containers, avoiding the use of excessive hammering and jarring which would damage the electrical equipment contained therein. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

E. Have conduit and all items in cardboard boxes shipped and stored on wooden pallets. Have boxes labeled from the factory to easily indicate materials inside and what electrical designation they are for. Utilize factory-fabricated type containers or wrappings for equipment and components which protect them from damage.

F. Coordinate shipping of large equipment with the construction timing of the building to ensure building is “dried in” or equipment can be moved in or out of building easily. If equipment needs to be

assembled and/or reassembled to get it out or into the building, then do so without voiding any manufacturer's warranty. Field verify all existing passageways, door ways, elevator sizes and capacities, window openings, etc. prior to bid to determine how to move equipment in and out. Modify openings as required to move equipment in and out.

G. Coordinate receiving of large items with unloading equipment on site or obtain rental equipment as required. Coordinate location, size, and weight of all large equipment items located inside the building with the Structural Engineer.

3.7 DEMOLITION

A. Contractor to disconnect and remove all associated electrical raceways, fittings, boxes, covers, cabling, supports, wiring devices, systems devices, light fixtures, etc. in or on walls, in or on floors, in or on ceilings to be demolished, or as otherwise indicated on the drawings, or as required to coordinate with new construction work.

B. Contractor to patch any unused openings or holes left over from fasteners being removed to meet existing wall conditions. This includes firestopping of opening through fire-rated walls and floors.

C. Contractor to review architectural and electrical drawings for full extent of demolition work.

D. Abandoned raceway/boxes shall have all electrical wiring removed completely and not just made "safe," unless directed to reuse or extend on new work plans. Abandoned and exposed raceway/boxes shall also be removed where practical without creating additional demolition/restitution work for other trades, unless directed to reuse or extend on new work plans. Where directed to reuse or extend on new work plans, provide additional raceways and boxes to extend to location shown (panelboards, cable tray, etc.) and remove unused portion of raceways.

E. Contractor to maintain service to electrical equipment downstream of any existing devices to be demolished. Contractor to provide temporary services as needed to existing areas to remain in operation. Reroute existing circuits and/or re-feed from a new source as required to maintain them in full and permanent service.

F. Contractor to remove all unused low voltage cabling left over after demolition.

G. Electrical Contractor to coordinate with General Contractor, if G.C. is to perform all demolition, such that existing services are not interrupted and existing equipment to remain is not removed or disturbed.

H. Contractor to field survey extent of demolition prior to bid. Contractor shall not be excused from performing required work because they did not perform a thorough visit of the site. In some cases, information has been taken by the Engineer from "existing" drawings and shall need to be verified on site.

I. All equipment removed that is not scheduled for reuse shall be offered to the Owner for their retention. If the Owner elects to retain equipment, it shall be turned over to the Owner at the site. If not, the equipment shall be removed from the premises by this Contractor.

J. Under demolition notes, several words and phrases are used. These shall be interpreted to mean as follows:

1. Abandon: Disconnect designated equipment and remove respective conductors back to source, such as a panelboard, distribution panel, switchboard, switchgear, etc. or next device to remain in service. Alter respective panel legend accordingly.
2. Disconnect: Disconnect designated equipment and remove respective branch circuit wiring and affected exposed electrical equipment, such as boxes, raceways, fittings, supports, control wiring, etc.

    a. Remove conductors back to source such as panelboard, etc. Alter respective panelboard legend accordingly.
    b. Remove exposed raceway. When in unfinished areas such as mechanical equipment rooms, remove back to source. When in finished spaces, remove only that raceway which is exposed.
    c. Where raceway is above an existing suspended, accessible ceiling and that ceiling grid is being reused or replaced, remove the exposed raceway in the affected area. Concealed homeruns are to remain and may be reused at Contractor's option.

3. Disconnect and Reconnect: Disconnect designated items, remove and store same where necessary, and then reinstall item and reconnect to existing branch circuit and control.
4. Remove Branch Circuit and/or Feeder: Remove conductor and respective raceway, fittings, boxes, supports, etc.

K. Where existing building construction is to be altered to accommodate the planned renovations and/or an addition(s), alter existing electrical service and distribution system, intercom systems, fire alarm system, nurse call system, voice/data system, catv system, cctv system, security system, media retrieval system, etc., as shown on the drawings and as required for proper operation of the altered system.

L. Where existing accessible ceiling grid panels and grid support members are removed to permit the installation of new conduit, boxes, etc., it shall be the responsibility of this Contractor to reinstall the panels and grid support system to the satisfaction of the Architect. Damaged items shall be replaced at no cost to the Owner.

M. Remove all existing affected electrical equipment, devices, fixtures, boxes, etc. which are not incorporated into or are not necessary for the operation of new and/or existing electrical systems, making sure that no remaining fixtures, devices, or appliances are left without service.

N. Make sure that no remaining fixtures, devices, circuits, equipment, etc. within the occupied renovated area or adjacent areas are left without service.

1. Services and/or power outages and cutovers to be coordinated with Architect and Owner and done at Owner's convenience.
2. Modify existing "systems" as required to accommodate added equipment.
3. Remove abandoned accessible surface-mounted boxes and raceway. Abandoned accessible surface raceway shall be removed complete back to source.
4. Where an abandoned raceway penetrates floor, slab, wall, etc. raceway shall be cut below the surface. Seal the opening and restore respective surface to match surrounding surface as directed.
5. Where an abandoned raceway is not accessible, the raceway shall remain. Any accessible portions penetrating out of wall, floor, slab, etc. shall be cut off below the surface. Seal the opening and restore the respective surface to match the surrounding surface as directed.

    a. Perform cutting and patching required for demolition in accordance with this section.

6. Flush mounted outlet boxes which are abandoned or used for junction boxes and are not concealed by new construction shall have openings covered by a blank coverplate to match existing active coverplates.
7. Where an existing panelboard is altered, provide a new, accurate, typed legend.
8. Where work cannot be executed during normal working hours, this Contractor shall include in the Base Bid all necessary overtime pay to execute this Contractor’s scope of work.

3.8 ELECTRICAL EQUIPMENT COORDINATION AND INSTALLATION

A. When noted in the specifications or on the drawings that a certain manufacturer was the “basis of design,” the engineer has designed the project around the manufacturer (while allowing equals manufacturers where noted). The contractor and equal named manufacturers are responsible for coordinating equipment/programming/dimensions/weights/capacity, etc. differences for providing equipment from an equal named manufacturer as opposed to the manufacturer used as the “basis of design.”

B. When utilizing existing low voltage head-end equipment to serve new devices or equipment, Contractor/Manufacturer to verify existing equipment is capable of being reused and extended from prior to bid. Contractor/Manufacturer to provide any and all additional equipment, programming, power supplies, servers, monitors, racks, capacity, amplifiers, annunciation points, etc. to make new devices shown operate from the existing head-end equipment. No additional compensation will be made for equipment found out to be insufficient during construction.

C. When two or more items of the same equipment are required (i.e. switchgear, wiring devices and plates, low voltage systems, light fixtures of the same type, etc.), they shall be of the same manufacturer.

D. Comply with NECA 1.

E. Coordinate arrangement, mounting, and support of electrical equipment so connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

F. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

G. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

H. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

I. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements. Install additional conduit, cable tray, busway, pullboxes, spliceboxes, etc. where required to obtain maximum headroom or to avoid conflict with other work without additional cost to the Owner.

J. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

K. Right of Way: Give to raceways and piping systems installed at a required slope. Provide addition trenching, conduit, sleeves, fittings, etc. as required to accommodate adjacent systems.

L. Before installing any work, this Contractor shall see that it does not interfere with clearance required for finish on beams, columns, pilasters, walls or other structural or architectural members, as shown on Architectural Drawings. If any work is so installed and it later develops that Architectural design cannot be followed, Contractor shall, at his own expense, make such changes in his work as the Architect may direct to permit completion of Architectural work in accordance with plans and specifications.

M. Report any interferences between work under this division and that of any other Contractors to the Architect as soon as they are discovered. The Architect will determine which equipment shall be relocated, regardless of which was first installed, and his decision shall be final.

N. Contractor shall coordinate with the Owner for the Owner to make required applications for electrical, telephone, cable television, etc. services in a timely fashion so as to not impede the flow of work.

O. Verify all dimensions by field measurements.

P. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.

Q. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

R. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

S. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

T. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components.

U. Secure all ceiling mounted devices tightly to ceiling (i.e. smoke detectors, occupancy sensors, exit signs, etc.)

V. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

W. Raceways, cable trays, conductors, etc., installed above ceilings or on exposed ceilings shall be supported from the building structure and shall be installed symmetrical with the axis of the space (do not cross room at an angle).

3.9 EQUIPMENT WIRING AND EQUIPMENT DIAGRAMS, DETAILS, AND RISERS

A. Wiring and elementary diagrams for equipment as shown on the drawings are based on the product of the specified equipment manufacturer and are shown for convenience to aid in estimating the extent of the work involved. The equipment actually installed shall be wired and connected in accordance with the equipment manufacturer's recommendations and shall conform to details in approved wiring diagrams to be furnished by the equipment manufacturer. All equipment so connected shall be made to operate in a safe, proper and efficient manner. Note that control circuitry is not necessarily shown on the drawings but shall be installed in conduit between the points and devices indicated on the diagrams.

B. Unless otherwise shown on the drawings or specified herein, it is the intent of this Division to provide all electrical equipment and connections required to protect, properly operate, and control all motors, appliances, electrical devices, and equipment furnished and

installed under this and other Divisions of the specifications or shown on the drawings.

C. Wiring of Motors and/or Equipment:

1. Provide necessary power wiring to motors and/or equipment where shown on Drawings.

   a. Make final "line" side connections to respective items of equipment as shown on Drawings.
   b. Provide "Control" wiring, regardless of voltage, only when shown on Electrical Drawings.
   c. In general, all 120, 208, 240, 277, or 480 volt wiring to be construed as power wiring; however, line voltage control wiring shall not be construed as power wiring unless shown on Electrical Drawings.

D. Wiring of Heating, Ventilating, and Air Conditioning Equipment:

1. Provide power wiring as shown on Electrical Drawings. In general, this shall consist of power conductors and raceway up to and including connections to line terminals of respective items of equipment.

   a. Where this Contractor furnishes motor starter and/or disconnect switch, this also shall include the power wiring between the load side of starter and/or disconnect switch and line terminals of respective item of equipment.
   b. Where other Divisions furnish motor starter and/or disconnect switch (other than factory-mounted, prewired items), this Contractor shall provide power wiring as described in previous paragraph and shall mount respective starter and/or disconnect switch.
   c. Where electric heating equipment is involved, wiring responsibilities to be as shown on Electrical Drawings.
   d. Control wiring, regardless of voltage characteristics, is not to be construed as power wiring and is not the responsibility of this Contractor unless indicated as such on Electrical Drawings. In certain cases, such as between a line voltage thermostat and a cabinet heater or a unit heater, or between a switch and a small exhaust fan, wiring may be required by this Contractor only if shown on Electrical Drawings.
   e. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving mechanical equipment, to verify with respective equipment supplier the required minimum circuit ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born by Division 23 directly to Division 26.
   f. It shall be the responsibility of this Contractor to coordinate power requirements and locations for all

temperature controls panels that are vendor specific and not necessarily shown on the drawings.

E. Wiring of Plumbing Equipment:

1. Provide necessary power wiring to plumbing equipment requiring same, where shown on Electrical Drawings.
2. Control equipment such as thermostats, pressure switches, etc., to be furnished, set in place, and wired by other Divisions, unless shown otherwise on Electrical Drawings.
3. Provide necessary disconnect switches, starters, or contactors where shown on Electrical Drawings. Refer to the motor controller section of these Specifications.
4. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving plumbing equipment, to verify with respective equipment supplier the required minimum circuit ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born by Division 22 directly to Division 26.
5. Coordinate rough-in heights of all water coolers and electronic sensor operated devices.

F. Wiring of Fire Protection Equipment:

1. Provide necessary power wiring to fire protection equipment requiring same, where shown on Electrical Drawings.
2. Control equipment to be furnished, set in place, and wired by other Divisions, unless shown otherwise on Electrical Drawings.
3. Control wiring from integral automatic transfer switches provided by others to generator to be performed by this Contractor.
4. Control/Annunciator wiring from Fire Pump controller provided by others to fire alarm panel to be performed by this Contractor.
5. Provide necessary disconnect switches, starters, or contactors where shown on Electrical Drawings. Refer to the motor controller section of these Specifications.
6. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving fire protection equipment, to verify with respective equipment supplier the required minimum circuit ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born by Division 21 directly to Division 26.

G. Wiring of Kitchen Equipment:

1. Provide necessary conduit, wire, disconnect switches, and connections to all kitchen equipment shown on Drawings.

2. Provide power wiring from panel to demark point such as a disconnect switch; however, control wiring to be responsibility of others unless shown otherwise on Drawings.
3. It shall be the responsibility of this Contractor to obtain the exact location and mounting heights of all junction boxes, outlets, conduit stubs, etc., from kitchen equipment supplier before installation of same. (NOTE: Locations shown on Drawings are only approximate and may vary with different equipment.)
4. Use "Sealtite" conduit and fittings for final connections to dishwashers, booster heaters, disposals, and other motor driven equipment.
5. Disconnect switches under sinks and counters to have NEMA 3R enclosures.
6. Coordinate all Nema plug, wire quantity/size, and receptacle configurations with Kitchen Contractor. Wiring of Temperature Control Equipment.
7. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving kitchen equipment, to verify with respective equipment supplier the required minimum circuit ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born the General Contractor providing this kitchen equipment directly to Division 26.

H. Temperature control wiring, regardless of voltage characteristics, is not the responsibility of this Contractor unless indicated as such on Electrical Drawings or herein described.

1. In general, the furnishing and installing of all temperature control devices and respective wiring shall be the responsibility of other Divisions.

I. Wiring of Motor Operated, Power Assisted, Automatic Doors/Partitions/Blinds/Projection Screens, or Security Type Doors (with card readers, proximity sensors, pushpads, 3-position momentary pushbuttons, magnetic locks, electric latches, electric hinges, power supplies, etc. specified in other sections):

1. All control devices, such as pushbuttons, limit switches, pushpads, power supplies, security devices, etc., shall be furnished in other Sections, and installed and wired by this Contractor, unless shown otherwise on the Electrical Drawings or Specifications.
2. Power wiring up to and including termination to the overhead door motor system main control panel, power supply, or junction box, and to the motor from same, if not factory prewired shall be the responsibility of this Contractor.
3. Refer to the Door Hardware Schedule in the drawings and Door Hardware Specification for a complete list of materials.
4. The flexible conduit required to serve as a raceway for the door contacts, magnetic locks, electric hinges, etc. <u>must</u> be concealed for all new construction. This includes close coordination

between the G.C. and E.C. regarding installation of door frames and/or aluminum storefront.

5. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving the above equipment, to verify with respective equipment supplier the required ampacity and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall be borne by the General Contractor providing this equipment directly to Division 26.

J. Wiring of Electric Dryers, Dishwashers, and Ranges:

1. E.C. to provide type “SO” cord whips for all connections to these pieces of equipment. E.C. to provide matching receptacles and plugs. All new dryers and ranges shall be a 4-wire cord and cord connector, unless otherwise noted.
2. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving the above appliances, to verify with respective equipment supplier the required minimum circuit ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born the General Contractor providing this equipment directly to Division 26.

K. Wiring of Medical Equipment:

1. All equipment shall be furnished and installed by the General Contractor and wired by the Electrical Contractor, unless otherwise noted.
2. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving the above appliances, to verify with respective equipment supplier the required minimum circuit ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born the General Contractor providing this equipment directly to Division 26.

3.10 EXCAVATION, BACKFILL, AND COMPACTION

A. This Contractor shall provide all excavation, backfill, and compaction required for the work covered under this Division.

B. Excavation:

1. Verify the location of all underground piping, foundations and any other underground utilities before commencing work. Perform survey work and acquire existing drawings as required to determine existing conditions. All existing underground utilities shall be supported and protected from damage. Contact proper authorities and/or the local “Call Before You Dig” utility service prior to excavation. If there are any major discoveries, bring them immediately to the attention of the Architect and Owner prior to excavation. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
2. Acquire and/or review survey of site and testing boring data to assist in determining soil content.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.
5. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Where trenches cross roads, walks, or public thoroughfares, provide suitable barricades and bridges adequately protected by signs or red flags during day and lights at night.
6. Excavation shall be made to the proper depths. If excavation is carried below that required, the bottom shall be brought to the required elevation with sand fill, thoroughly compacted.
7. Slope sides of excavations to comply with local codes and ordinances.
8. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Shore and brace as required for stability of excavation. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
9. Install sediment and erosion control measures, such as silt fences, in accordance with local codes and ordinances.
10. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-

off areas. Do not use trench excavations as temporary drainage ditches.

11. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
12. Remove off of Owner’s property and legally dispose of excess excavated materials and trash, debris and waste materials not acceptable for use as backfill or fill.
13. Excavation for Underground Vaults and Electrical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
14. Excavation for Equipment Pads: Provide excavation for concrete pad and required aggregate backfill according to contour lines provided by Civil Engineer.
15. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
16. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 inches clearance on both sides of raceways and equipment.
17. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
18. Where rock is encountered, first attempt to break up rock with rocker trencher, jackhammer, or other heavy machinery as required. Consult with Owner prior to using any explosive materials. Carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.
19. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F (1 deg C).
20. When excavation is required underneath an existing roadway, coordinate with Owner/Utility whether or not boring is required in lieu of excavation.
21. Where conduits pass below footings, install steel pipe sleeves (unless the conduits are required to turn up on the adjacent exterior wall) with at least 2" clearance all around conduit and fill excavation to the bottom of the footing with concrete. Where conduits pass through subgrade walls, install steel pipe sleeves with at least 2" clearance all around conduit. Fill annular space around conduit with inorganic compressible filler to provide a watertight seal.
22. Where holes are to be drilled for direct buried poles or the like, use hand or machine powered auger to proper depth required by manufacturer.
23. Ducts shall be pitched to drain toward manholes and handholes and away from buildings and equipment. Minimum slope shall be 4 inches per 100 linear feet. Where necessary to achieve this

between manholes, ducts shall be sloped from a high point in the run to drain in both directions.

C. Backfill:

1. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified below:

   a. Backfill around conduits in bottom of trench shall be clean sand, unless otherwise indicated to be concrete. Provide a 3″ separation between each conduit and between the conduits and the trench. Utilize PVC base and intermediate spacers to accomplish separation. Secure spacers to trench and to conduits with tie wire to ensure conduits do not shift during backfill installation.
   b. Backfill above conduits to subgrade shall consist of existing suitable dirt backfill, unless otherwise noted. Existing backfill shall be free of trash, rock, or other debris. Existing excavated materials may be used in the sentence above, provided it can be readily compacted.
   c. Concrete backfill shall be required around conduits when feeder conduits (not for branch circuits, unless otherwise noted) pass under a roadway or parking lot or are otherwise indicated herein or on the drawings. Concrete reinforcing steel cages (of #4 rebar) are also required around concrete encased conduits when indicated herein or on the drawings. Where concrete encasing is required around the conduits passing underneath a roadway or parking lot, provide a course interlocking aggregate stone backfill above the concrete encasement to subgrade.

2. Backfill excavations as promptly as work permits, but not until completion of the following:

   a. Inspection, testing, approval, and locations of underground utilities have been recorded.
   b. Removal of concrete formwork.
   c. Removal of shoring and bracing, and backfilling of voids.
   d. Removal of trash and debris.

3. Place backfill and fill materials evenly adjacent to structures, conduit, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
4. Underground Line Warning Tape: Refer to Section 260553 “Identification for Electrical Systems” for specific types of warning tape. Install warning tape during backfill at 6-8″ below sub-grade.
5. Inspection: Backfilling shall not be made until wiring or conduit has been inspected by Architect/Engineer.

D. Compaction:

1. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required

percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
3. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

    a. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

        1. Areas Other Than Under Building or Pavement: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.

    b. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

4. Subsidence: Where subsidence occurs at electrical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.11 FIRE STOPPING

A. All fire and smoke rated walls/floors/partitions penetrated by electrical raceways, exposed conductors, etc. shall be properly sleeved and fire sealed. Perform fire stopping to re-establish the original fire resistance rating of the assembly at the penetration. Refer to architectural drawings for all fire rated floors and walls for location, hour rating, and construction type. Verify with Architect the ratings of existing walls and floors to determine the proper U.L. assembly required.

B. All fire stopping will be installed in accordance to the U.L. rated system and State requirements designed for the application.

C. Insulation types specified in other sections shall not be installed in lieu of fire stopping material specified herein. Fire stopping can be accomplished by using a combination of UL approved materials and devices, including penetrating raceway, cable tray, or cables, required to make up a complete approved fire stop installation. Rock wool may be partially utilized for larger opening voids, when it does not void the U.L. listed assembly.

D. Unapproved grout, mortar, or gypsum products shall not be installed in lieu of fire stopping material specified herein.

E. Sleeves: Install sleeves during the erection of concrete or masonry walls. Sleeve shall be grouted in using material to match surrounding surface. Install electrical raceway, exposed conductors, etc. through sleeve and install fire stopping, intumescent material.

F. Contractor to verify that cabling and other penetrating elements and supporting devices have been completely installed and temporary lines and cables have been removed prior to fire stopping installation.

G. Contractor to perform all necessary coordination with other trades constructing floors, walls, or other partitions of building construction with respect to size and shape of each opening to be constructed, wall/floor construction type, and device or system approved for use in each instance.

H. Coordinate each firestop selection with adjacent work for dimensional or other interference and for feasibility. In areas accessible to public and other "finished" areas, firestop systems work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.

I. Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of fire stopping. Remove combustible installation aids after fire stopping material has cured.

J. Assemblies consisting of individual steel hat type restricting collars filled with intumescent type materials that completely surround communications penetration shall be used for nonmetallic raceways and cabling.

K. Provide daily sign off in a formalized log on site of each penetration created and firestopped.

L. Provide fire stopping in the following areas at a minimum:

1. Where penetrations including conduit, cable, wire, or other elements which pass through one or both outer surfaces of a fire rated floor or wall.
2. Except for floor on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof.
3. Where a penetration occurs through fire-rated walls, or partitions of hollow-type construction, provide fire stopping to

completely fill spaces around the penetration, on each side of the wall or partition.

4. These requirements for penetrations shall apply whether or not sleeves have been provided, and whether or not penetrations are to be equipped with escutcheons or other trim. If penetrations are sleeved, fire stop annular space, if any, between sleeve and wall opening.
5. Apply fire stopping to all electrical penetration voids in wall or floor or between sleeve and penetrating material left over from the demolition phase, whether the voids were existing or created by this Contractor.
6. If required by inspecting authorities:

    a. Expose and remove fire stopping to the extent directed by inspecting authority to permit his or her inspection.
    b. Reinstall new fire stopping and restore Work where removed for inspection.

7. Apply watertight fire stopping sealant between cables and associated conduit penetrations into a manhole. Wrap exposed cables in manhole with approved fire-wrapping tape.
8. Apply fire stop putty around 4″ square outlet boxes serving opposite rooms but sharing a common fire rated wall, where the boxes are less than 24″ apart (edge to edge), regardless of whether they are separated by metal studs or not.

3.12 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Division 26. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by excavation, trenching, storing of dirt, cable laying, cutting of roadway or sidewalk, and other activities to their original condition to the satisfaction of the Architect. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Section 02 "Landscaping." Maintain restored surfaces.

3.13 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable electrical and mechanical systems in every respect.

B. The drawings are diagrammatic only, intending to show general arrangement and location of system components. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown, but shall be provided at no change in contract price.

C. All work shall be accurately laid out and coordinated with other trades to avoid conflicts and to provide maximum accessibility for operation and maintenance.

3.14 INTERRUPTION OF EXISTING ELECTRICAL SERVICES

A. Do not interrupt electrical, fire alarm, voice/data, nurse call, CATV, CCTV, radio, intercom, etc. service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of electrical service.
2. Indicate method of providing temporary utilities.
3. Do not proceed with interruption of electrical service without Architect's and Owner's written permission.

3.15 LUG RATINGS

A. All wiring lugs used throughout the project, including but not limited to: overcurrent protection devices, switchgear lugs, wiring device terminals, motor terminals, equipment terminals, etc. shall be rated for use with 75 degree minimum conductors.

3.16 PAINTING AND CAULKING

A. Coordinate and schedule painting of exposed raceways, boxes, and fittings with G.C. to avoid unnecessary trips by the G.C. and/or their subcontractor. All field painting shall be performed by the G.C. according to Division 09 “Finishes” unless otherwise noted herein or on the drawings.

B. Suitable finish coatings shall be provided under this section of the Specifications on all items of electrical equipment and wiring which are exposed. This shall consist of either an approved factory applied finish or an acceptable finish applied during or after installation. Equipment which is furnished in finishes such as stainless steel or satin aluminum is not to be painted. Exposed equipment and/or wiring in finished areas such as panel covers or surface raceway shall be supplied with factory applied prime coat and shall be professionally painted or enameled as directed to result in a completely coated and attractively finished manner. All such finishing shall be as directed and shall be satisfactory to the Architect/Engineer.

C. All factory-finished steel surfaces; boxes, enclosures, etc., shall be cleaned and retouched or repainted as necessary to provide a rust-resistant coating. Where painting or galvanizing is not specifically specified, ferrous devices, bolts, nuts, inserts, etc., shall be galvanized.

D. All nameplates and specially colored electrical equipment (such as fire alarm devices) shall be left unpainted and in a clean condition.

E. Coordinate installation of wiring devices and covers with G.C. to avoid overspray onto devices and/or covers. Provide temporary protection over the wiring devices, if installed ahead of painting, as required to prevent such overspray.

F. All caulking shall be performed by the G.C. unless otherwise noted herein or on the drawings. G.C. shall be responsible for caulking, and then painting, around all openings in walls that the G.C. cut larger then the device cover plate will cover up.

G. Where new electrical metallic equipment (i.e. surface raceway, conduit, boxes, panelboard tubs, etc. and not non-metallic surface raceway) is exposed on walls or ceilings to be painted, E.C. shall coordinate the timeliness of this work with the G.C. to ensure all is painted.

H. Where existing electrical equipment has been removed from an existing wall to remain (i.e. surface raceway and boxes, panelboards, etc.), G.C. shall patch and paint existing wall to match adjacent materials.

3.17 PHASING

A. Perform work in separate phases as required by the Architect/Engineer according to criteria herein or in Division 01 along with architectural/electrical drawings.

B. Contractor to take careful consideration to existing utilities (power, fire alarm, etc.) that need to be operational despite work being performed in adjacent areas. Contractor to provide temporary services, as required, maintaining existing systems otherwise affected by work in adjacent area.

3.18 RENOVATION PROJECTS

A. For renovation projects, where a portion of the building is to remain as is, the Contractor shall be responsible for determining and submitting on new equipment finishes that match existing for the renovated areas. Typical equipment to be considered are: exit signs, wiring device colors, wiring device cover plates, lamp color temperature, fire alarm devices, speakers, etc.

3.19 ROUGH-IN

A. In general, individual mounting heights of outlets, switches, etc. are not noted on the drawings. Details and notes specify “standard” mounting heights for these items. Contractor shall carefully study elevations of all walls and cabinet work as shown on architectural plans and locate outlets to given space and avoid all conflicts. Outlets shall always be located above, and not in, backsplashes. Coordinate location of outlets with other trades to avoid conflicts. Any conflict that cannot be resolved in the field shall be brought to the attention of the Architect prior to rough-in.

B. In general, the electrical drawing symbols and locations are not shown to an exact scale for legibility reasons. Field verify with Architect prior to rough-in, exact location and mounting heights of all electrical items such as switches, receptacles, clocks, speakers, call-in stations, fire alarm devices, nurse call stations, television outlets and associated receptacles, voice/data outlets, cctv monitors and cameras, floor boxes, poke-through assemblies, surface mounted

raceways, wall mounted light fixtures, light poles, overhead projectors, etc., in all finished areas.

C. In general, where voice/data outlets and cable tv outlets and associated power receptacles are shown near each other but on separate plans, they shall be located adjacent to each other no more than 12″ apart.

D. Verify with respective equipment supplier or Contractor prior to rough-in, exact location, electrical characteristics, and method of connection to respective equipment for such items as mechanical/plumbing/fire protection/kitchen/laundry/medical equipment, etc.

E. Where coursing of masonry block precludes the specified mounting height of an outlet such that the rough-in box would be located in the center of a cell, Contractor shall have the ability to adjust mounting heights slightly to work out with the coursing so that the rough-in box sits on the bottom or top of a course.

F. Refer to lintel schedule on Structural Drawings for requirements when penetrating wall with raceways.

3.20 SITE VISITS

A. All persons proposing to submit quotations for work in accordance with these plans and specifications are expected to visit the site of the work covered by the plans and specifications and are to familiarize themselves with existing conditions as they affect the work of this section of the specifications. Claims resulting from a failure to visit the site or inspect the existing conditions will not be considered. Existing wall/floor thicknesses and types shall be verified for required penetrations. Existing head-end equipment for low voltage systems being reused shall be verified by the prospective (sub) Contractors to ensure that they include any and all necessary equipment and programming costs in their Bid. Where existing switchgear is being modified or added onto, Contactor shall verify existing equipment and requirements for modifications/additions.

3.21 SLEEVES FOR ABOVE GRADE RACEWAYS AND CABLES

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies. Refer to architectural drawings for fire rated wall/floor area locations and ratings.

B. Coordinate sleeve selection and application with selection and application of fire stopping specified in this section.

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Extend sleeves installed in walls 2 inches (50 mm) past each side of the wall.

I. Size pipe sleeves at two trade sizes bigger than the penetrating conduit unless seismic criteria require a different clearance.

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 "Joint Sealants" for materials and installation.

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible “Pate” boot-type flashing units applied in coordination with roofing work.

N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

O. Sleeves shall not share openings with any other penetration (i.e. ductwork).

3.22 TEMPORARY PROTECTION OF ELECTRICAL EQUIPMENT

A. This contractor shall temporarily protect all electrical equipment from construction dust, dirt, debris, overspray, mud, etc. This equipment includes but it not limited to: sensitive electronic devices such as fire alarm and voice/data equipment, indirect/direct suspended light fixtures, indirect/direct recessed light fixtures, parabolic

louvered light fixtures, wiring devices, etc. Contractor shall remove temporary covering for testing purposes and once the final building cleanup has been performed.

3.23 TEMPORARY POWER AND LIGHTING

A. The E.C. shall provide temporary 120/208/240 volt, single phase power and lighting for useage by all trades during construction until the permanent power is activated.

B. Temporary electrical panels shall be provided on each floor at a minimum or otherwise required to be reached from a 100’ extension cord.

C. Special three phase temporary power or circuits larger than 60 amps required by other trades shall be acquired through a portable generator from that specific trade and not from the E.C. unless they agree to do so at their expense.

D. Interior temporary lighting shall be provided in every working space and area of egress consisting of at least one 100 watt lamp per 100 square feet.

E. Exterior temporary lighting shall be provided where permanent site lighting is not yet available. Light towers powered from the temporary service or portable generators shall be provided for exterior site illumination as required for general vehicular and pedestrian traffic.

F. Temporary power distribution shall be provided in the form of multiple 20 amp, GFCI receptacles at the temporary panels or 20 amp, GFCI circuit breakers.

G. Install and maintain temporary utilities according to OSHA requirements.

H. Permanent light fixtures may be used for temporary lighting as long as they are relamped and cleaned upon Substantial Completion and there is no discernable damage to the fixture.

I. Remove all temporary wiring, lighting, and receptacles upon activation to permanent power. Patch all temporary penetrations with approved compound.

J. Temporary services ran underground must be installed in conduit and the temporary conductors shall be removed when the permanent service is on line.

K. Contractor shall provide temporary normal and life safety lighting fixtures, raceways, circuits, etc. as required for any temporary protective construction canopies installed over existing exterior egress paths.

3.24 TEMPORARY POWER USEAGE FEES

A. The Contractor, at his/her own expense, shall make arrangements for the purchase of power or portable power and provide (or coordinate with the Owner) for the extension of Owner power to the point of usage. The usage costs of temporary electrical power shall be included in the Bid by the G.C., unless otherwise noted in Division 01.

END OF SECTION 26 05 00

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

B. Related Sections include the following:

1. Section 260500 "Common Work Results for Electrical" for related firestopping work.
2. Section 260590 “Electrical Testing” for testing requirements of conductors and cables.
3. All Division 27 and 28 “Systems” Sections for cabling requirements included in those sections.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field Quality-Control Test Reports: From Contractor.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Wiring and Cabling: Listed by an “approved” third-party testing agency.

D. Comply with NEMA WC 3 for rubber insulated wire and cable, WC 5 for thermoplastic insulated wire and cable, and WC 7 for crosslinked polyethylene insulated wire and cable.

E. All wire and cable shall be listed by an “approved” third-party testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CONDUCTORS AND CABLES

A. Manufacturers:

1. American Insulated Wire Corp.; a Leviton Company.
2. Essex Electric.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.
6. Or approved as equal as determined by the Engineer.

B. Conductor Material: Solid copper conductor for power and lighting circuits No. 10 AWG and smaller, copper stranded for power and lighting circuits No. 8 AWG and larger. Copper stranded conductors shall be allowed for all low voltage systems wiring.

C. Conductor Insulation Types: Type THHN-THWN, XHHW, and SO.

D. Multiconductor Cable: Metal-clad cable, Type MC and Type SO with ground wire. Refer to Part 3 for acceptable installation methods.

E. Maximum Conductor Size: 750 KCMIL. Coordinate wire size with lug manufacturers.

F. Minimum Power and Lighting Conductor Size: #12 AWG.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. Ideal.
5. Ilsco.
6. O-Z/Gedney; EGS Electrical Group LLC.
7. Thomas & Betts.
8. 3M Company; Electrical Products Division.
9. Or approved equal as determined by the Engineer.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.

H. Underground Feeders and Branch Circuits: Type THHN-THWN, single conductors in raceway.

I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.

J. Fire Alarm Circuits: Type THHN-THWN and power-limited, fire-protective, signaling circuit cable, in raceway.

K. Class 1 Control Circuits: Type THHN-THWN, in raceway.

L. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

A. Conceal cables within raceways, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Unless otherwise noted, all cables at exposed ceilings or walls shall be concealed in conduit. If allowed by Engineer, install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Where exposed cables are not installed in cable trays and allowed in other sections of the project documents, they shall be supported by j-hooks. J-hooks shall be sized according to the cable fill capacities

published by the manufacturer and allowed by NEC and/or BISCI. J-hooks shall be supported by rigid all thread to the structure and not tie wire or ceiling wire. Cables shall not be supported by the following methods: strapped to outside of a cable tray, strapped to a conduit or pipe, lay on the ceiling surface, lay on structural supports, lay on light fixtures, etc.

F. Seal around cables penetrating fire-rated elements according to 260500 "Common Work Results for Electrical."

G. Seal around cables penetrating from roofs or from the exterior through a wall or floor with duct seal.

H. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

I. Voltage Drop: Conductors for branch circuits shall be sized to prevent a voltage drop exceeding three percent at the farthest outlet, fixture, motor, or equipment load. Conductors for panel feeder circuits shall be sized to prevent a voltage drop exceeding two percent at the panelboard. Total maximum voltage drop on both feeders and branch circuits to the farthest outlet shall not exceed five percent. Voltage drop criteria specified in this paragraph and the table below shall override standard wire sizes for associated circuit breakers that may be shown on the panelboard schedules on the drawings.

J. Voltage Drop Table: Using a 20 amp branch circuit as an example, all wiring shall be in accordance with the following minimal values listed in this table:

Voltage:	Distance:	Home Run:	Remainder of Circuit:
120/208 V	0′ – 50′	#12	#12
	50′ – 100′	#10	#12
	100′ – 150′	#8	#10
	150′ – 250′	#6	#10
277/480 V	0′ – 125′	#12	#12
	125′ – 220′	#10	#12
	220′– 330′	#8	#10

K. Provide no more than three current carrying conductors (hot circuits), three dedicated neutral conductors, and one equipment grounding conductor in any conduit homerun, unless directed by this Engineer.

L. The number of conductors in each run of conduit is indicated on the drawings and where there is a conflict between the number of wires indicated and the actual number required as determined by the functional design requirements, the number of wires determined by the functional design requirements shall govern.

M. The branch circuit wiring has been designed to utilize the advantages of multi-wire (3H + 3N + 1G) distribution and shall be installed substantially as indicated on the drawings. No major changes in the grouping or general routing of the branch circuits shall be made

without the approval of the Engineer in writing. Branch circuit changes, once made, shall be updated on the as-built drawings and panelboard directories.

N. Install a dedicated neutral conductor for each phase (hot) conductor for each dimmed lighting circuit, along with each single pole circuit.

O. Install a dedicated neutral conductor for each GFI branch circuit.

3.3 CONNECTIONS

A. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

B. Install electrical connections in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating and mechanical strength, than electrical insulation rating of those conductors being spliced.

E. Prepare wires/cables, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where wires/cables are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

F. Trim wires/cables as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.

H. Joints in solid conductors shall be spliced using Ideal “wirenuts”, 3M Company “Scotchlok”, or T&B “Piggy” connectors in indoor and dry location junction boxes, outlet boxes, and lighting fixtures.

I. Joints in stranded conductors shall be spliced by approved mechanical connectors (such as split bolts) and gum rubber tape or friction tape. Solderless mechanical connectors for splices and taps, provided with

UL approved insulating covers, may be used instead of mechanical connectors plus tape.

J. Joints in outdoor locations such as handholes, pole light bases, ground mounted light fixtures, wireways, junction boxes, etc. shall be spliced by approved mechanical connectors, such as split bolts and gum rubber tape or friction tape or “Ilsco” type connectors.

K. “Sta-kon” style permanent crimp ring or fork connectors shall not be used for stranded conductor branch circuit connections.

L. Conductors, in all cases, shall be continuous from outlet to outlet, device to device, box to box, etc. and no splicing shall be made except within outlet or junction boxes, troughs, and gutters.

M. Train and route cables terminating in a loadcenter, panelboard, switchboard, switchgear, etc. directly from the raceway to the respective termination point (OCPD or bar) with as few bends as possible. Bend the cable prior to termination neatly and consisting with bend radius according to manufacturer’s recommendations.

N. Provide a minimum 12” slack loop on all low voltage devices prior to termination at the device. This includes recessed ceiling speakers, recessed occupancy sensors and power packs, voice/data outlet, security devices, nurse call devices, fire alarm devices, etc.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
4. Provide copy of test reports in the O&M closeout information.

END OF SECTION 26 05 19

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and all Division 26 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Section 260500 "Common Work Results for Electrical" for concrete foundation work.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Vibration isolation requirements for electrical equipment and systems.
3. Seismic restraints for electrical equipment and systems.
4. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 SUBMITTALS

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.

1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
2. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices. Include the following:

1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.
2. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
    c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC and SMACNA, as dictated by the Architectural/Structural Engineering drawings, unless requirements in this Section are more stringent.

B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Vertical Cable Supports: Comply with NEC Article 300.19.

1.6 PROJECT CONDITIONS

A. Seismic Design Category as Defined in the IBC: C.

B. Seismic Importance Factor: 1.0 for all non-life safety equipment and 1.5 for all life safety equipment.

C. Verify all seismic criteria with Architect prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified below.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project. Verify with Structural Engineer the minimum structural safety factor times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Manufacturers:

a. Cooper B-Line; a division of Cooper Industries.
b. ERICO International Corporation.
c. Allied Support Systems; Power-Strut Unit.
d. GS Metals Corp.
e. Michigan Hanger Co., Inc.; O-Strut Div.
f. Thomas & Betts Corporation.
g. Unistrut; Tyco International, Ltd.
h. Or approved equal as determined by the Engineer.

2. Finishes:

a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
c. Painted Coatings: Manufacturer's standard green painted coating applied according to MFMA-3.

3. Size: 1-5/8″ x 1-5/8″, 12 gauge, minimum.

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Manufacturers:

a. Allied Support Systems; Aickinstrut Unit.
b. Cooper B-Line; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.
d. Seasafe, Inc.
e. Or approved equal as determined by the Engineer.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
4. Rated Strength: Selected to suit structural loading and applicable seismic forces.

5. Size: 1-5/8″ x 1-5/8″, 12 gauge, minimum.

D. Raceway and Cable Supports: As described in NECA 1.

E. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Not allowed for Seismic Design Category D, E, or F. If permitted by Structural Engineer, Architect, and Owner, provide threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. Manufacturers:

      1) Hilti, Inc.
      2) ITW Construction Products.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co. Inc.
      5) Ramset/Redhead.
      6) Or approved equal as determined by the Engineer.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used. Provide anchors that are seismically approved and properly selected, based on design calculations through the center or gravity. Anchor bolts must be embedded and spaced in accordance with ICBO standards.

   a. Manufacturers:

      1) Cooper B-Line; a division of Cooper Industries.
      2) Hilti, Inc.
      3) ITW Construction Products.
      4) MKT Fastening, LLC.
      5) Powers Fasteners.
      6) Or approved equal as determined by the Engineer.

3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type for hollow masonry walls.

7. Hanger Rods: Threaded steel.
8. Drop-In Anchors: Carbon steel with bolt insert for solid concrete walls and floors.
9. Nail-In Anchors: Zamac alloy with carbon steel drive pin.
10. Machine Screws or Self-Tapping/Self-Drilling Screws: For metal surfaces.
11. Wood Screws: For wood construction.

2.3 SEISMIC-RESTRAINT COMPONENTS

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project. Verify with Structural Engineer the minimum structural safety factor times the applied force.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Tray Restraints: Provide separate 45 degree angled bracing to the structure every 30 linear feet and at each change in direction.

D. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. Manufacturers:

a. Amber/Booth Company, Inc.
b. Loos & Co., Inc.
c. Mason Industries, Inc.
d. Or approved equal as determined by the Engineer.

2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
4. Bushings for Floor-Mounted Equipment Anchors: Separate double acting seismic snubbers with Neoprene cushioned interfaces designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for conduit as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction
2. Secure raceways and cables to these supports with two-bolt conduit clamps single-bolt conduit clamps single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

E. Use steel slotted U-channel in most all applications, except corrosive, wet, and outdoor locations where nonmetallic shall be used.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

A. Comply with NECA 1 and Civil Engineering drawings and specifications for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, conduit may be supported by openings through structure members, as permitted in NFPA 70. Conduits sized 2-1/2″ and larger to have special seismic support design including angle iron type bracing.

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to

carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder or pneumatic-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick. Verify with Structural Engineer prior to installation.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements. Install additional blocking in metal stud walls to support heavy wall mounted equipment such as transformers, distribution panelboards, transfer switches, etc.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

G. Junction and outlet boxes: Provide two studs to secure box to wall or ceiling in lieu of one.

H. Support all ceiling mounted equipment independently to the building structure (i.e. recessed light fixtures, recessed ceiling speakers, etc.). Provide at least four twists on the ceiling wire when tying up a piece of equipment.

I. Supports for floor mounted transformers, switchgear, transfer switches, etc: Provide neoprene rubber type isolators under each corner of the unit between the unit and the concrete base.

J. In seismic areas, conduit 2-1/2″ and larger must be braced, when supported more than 12″ below structure.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.

B. Construct concrete bases of dimensions required by manufacturer but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Use 2500-psi (17.2-MPa), 28-day compressive-strength concrete for all concrete ductbanks. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete for all equipment pads. Use 4000-psi (27.6-MPa), 28-day compressive-strength concrete for all light pole bases. Concrete materials, reinforcement, and placement requirements are specified in Section 260500 "Common Work Results for Electrical."
7. Provide #4 horizontal rebar grid as required.

C. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. Restraint Cables: Provide slack within maximums recommended by manufacturer.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.6 FIELD QUALITY CONTROL

A. Testing: Test pullout resistance of seismic anchorage devices.

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

B. Record test results.

END OF SECTION 26 05 29

SECTION 26 05 33
RACEWAYS, BOXES, AND FITTINGS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, cabinets, floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies for electrical wiring.

B. Related Sections include the following:

1. Section 260500 "Common Work Results for Electrical" for supports, anchors, identification products, access panels, and firestopping.
2. Section 260529 "Hangers and Supports for Electrical Systems" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.
3. Section 262726 "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 ABBREVIATIONS/DEFINITIONS

A. AC: Armored cable.

B. Duct Bank: A group of two or more ducts in a continuous run between two points.

C. EMT: Electrical metallic tubing.

D. ENT: Electrical nonmetallic tubing.

E. FMC: Flexible metal conduit.

F. GRC: Galvanized rigid steel conduit.

G. IMC: Intermediate metal conduit.

H. LFMC: Liquidtight flexible metal conduit.

I. MC: Metal clad cable.

J. PVC: Polyvinylchloride conduit.

K. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For conduit fittings, surface raceways and components, wireways and fittings, floor boxes, poke-through assemblies, hinged-cover enclosures, and cabinets.

B. Shop Drawings:

1. Design Calculations: Calculate requirements for selecting seismic restraints.
2. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Coordination Drawings: Coordinate with all trades to provide elevation drawings and reflected ceiling plans drawn to scale for coordinating congested areas and ceiling-mounted items, when requested by the Architect. Show the following:

1. Cable trays, lighting fixtures, feeder conduits, HVAC ductwork, HVAC piping, fire sprinkler piping, etc.
2. Ceiling suspension assembly members.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, detectors, and special moldings.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Section 260529 "Hangers and Supports for Electrical Systems". Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, cable tray, and partition assemblies.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Service/Power Poles: One for every 20, but no fewer than one.
2. Floor Service Outlet Assemblies: One for every 20, but no fewer than one.
3. Poke-Through, Fire-Rated Outlet Assemblies: One for every twenty floor service outlets installed, but no fewer than one.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT, TUBING, AND FITTINGS

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Shamrock.
10. Wheatland Tube Co.
11. Or approved equal as determined by the Engineer.

B. Galvanized Rigid Steel Conduit: ANSI C80.1.

1. Fittings: Use heavy duty threaded double locknut rigid steel conduit fittings along with thermoplastic bushings in a non-threaded hub installation, unless otherwise indicated. Set screw fittings are not permitted.

C. IMC Conduit: ANSI C80.6.

1. Fittings: Use heavy duty threaded double locknut rigid steel conduit fittings along with thermoplastic bushings in a non-threaded hub installation, unless otherwise indicated. Set screw fittings are not permitted.

D. EMT and Fittings: ANSI C80.3.

1. Fittings: Steel hexagonal compression type with insulated throat bushings. Set screw, die cast, and indented type fittings are not permitted. Utilize thermoplastic bushings and heavy duty steel locknuts as well.

E. FMC: Zinc-coated steel.

1. Fittings: Stamped steel, zinc plated, squeeze type with insulated throat bushings. Set screw and die cast are not permitted.

F. MC: Interlocking steel metallic tape flexible armor with factory installed cables.

1. Fittings: Stamped steel construction, zinc electroplated, squeeze or snap-in type with insulated throat bushings. Set screw and die cast are not permitted.

G. LFMC: Liquidtight flexible steel conduit with PVC jacket.

1. Fittings: Malleable iron, zinc plated, compression type with insulated throat. Die cast are not permitted.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:

1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corp.
4. Cantex Inc.
5. Certainteed Corp.; Pipe & Plastics Group.
6. Condux International.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; Division of Hubbell, Inc.
12. Southern Pipe Company.
13. Spiralduct, Inc./AFC Cable Systems, Inc.
14. Thomas & Betts Corporation.
15. Or approved equal as determined by the Engineer.

B. Rigid Non-Metallic Ducts and Fittings, Schedule 40 and 80: NEMA TC-2, Federal Specifications WC 1094A and UL 651 and to be UL listed.

C. Non-metallic conduit solvents and sealants to be as recommended by manufacturer of respective conduit manufacturer.

2.4 METAL WIREWAYS

A. Manufacturers:

1. Cutler Hammer.
2. Hoffman.
3. Square D.
4. Or approved equal as determined by the Engineer.

B. Material and Construction: Sheet metal sized, shaped, and NEMA rating as indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Hinged type for indoor. Flanged-and-gasketed type for outdoor.

F. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

A. Manufacturers:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.
3. Stahlin.
4. Or approved equal as determined by the Engineer.

B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

1. Manufacturers:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Walker/Wiremold Company (The).
c. Thomas & Betts/Steel City Corporation.

d. Or approved equal as determined by the Engineer.

B. Surface Nonmetallic Raceways: Two-channel construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color as selected by Architect.

1. Manufacturers:

a. Panduit “T-70” series.
b. Wiremold “40N2” series.
c. Steel City.
d. Or approved equal as determined by the Engineer.

C. Types, sizes, and channels as indicated and required for each application.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, dividers, covers, wire supports, external 90s, internal 90s, entrance end fittings, and other fittings to match and mate with wireways as required for complete system.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet-PLM Division.
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
14. Or approved equal as determined by the Engineer.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Minimum outlet box size 4″ square by 1-1/2″ deep. Gangable masonry boxes are to be minimum 3″ deep.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinged cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

I. Where concentric, eccentric or over-sized knockouts are encountered, a bonding bushing shall be provided.

2.8 FLOOR BOXES

A. Manufacturers:

1. Floor Boxes:

a. FSR, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Walker/Wiremold Company (The).
d. Thomas & Betts/Steel City Corporation.
e. Or approved equal as determined by the Engineer.

B. Floor Boxes: Cast iron metal or stamped steel, fully adjustable, rectangular for ground floor locations.

C. Type: Modular, flush-type with recessed activation cover, dual-service units suitable for wiring method used.

D. Compartments: Barrier separates power from voice, data, catv, or sound cabling.

E. Service Plate: Rectangular, solid brass.

F. Power Receptacle: NEMA WD 6, Configuration 5-20R, unless otherwise indicated.

G. Floor Boxes: Entire housing shall be removable for unrestricted access to all connector locknuts inside base. The unit shall provide for a minimum of 1 7/8" pre-pour adjustment and 3/4" post-pour adjustment for leveling. Provide quantity of power receptacles, voice/data outlets, microphone outlets, cable television outlets, A/V provisions, etc. as indicated on the drawings and coordinated with Government’s separate A/V Contractor. Where low voltage outlets are used, provide standard Decora (GFI) or 106 Frame (Duplex) type device brackets for use with standard floor box covers. Provide all required dividers/compartments, device brackets, coverplate inserts, coverplates, etc. for a complete installation.

2.9 POKE-THROUGH OUTLET ASSEMBLIES

A. Manufacturers:

1. Poke-Through Outlet Assemblies:

   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Thomas & Betts/Steel City Corporation.
   c. Walker/Wiremold Company (The).
   d. Or approved equal as determined by the Engineer.

B. Standards: All poke through assemblies must meet the “Scrub Water Exclusion” requirements of UL 514 A & C.

C. Description: Factory fabricated and wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.

1. Service Outlet Assembly: Flush type with either one duplex receptacle and two RJ-45 A/V jacks or with threaded opening for flexible conduit whip connection. Refer to drawings for requirements.
2. Size: Selected to fit nominal 3-inch (75-mm) cored holes in floor and matched to floor thickness.
3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
4. Closure Plug: Arranged to close unused 3-inch (75-mm) cored openings and reestablish fire rating of floor.
5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors; and a minimum of two, 4-pair, Category 6 voice and data communication cables.
6. Compartments: Barrier separates power from voice, data, catv, or sound cabling.
7. Service Cover and Flange Plate: Round, solid brass.
8. Provide quantity of power receptacles, voice/data outlets, microphone outlets, cable television outlets, A/V provisions, etc. as indicated on the drawings and coordinated with Government’s separate A/V Contractor. Where low voltage outlets are used, provide standard Decora (GFI) or 106 Frame (Duplex) type device brackets for use with standard floor box covers. Provide all required dividers/compartments, device brackets, coverplate inserts, coverplates, etc. for a complete installation.

2.10 MULTIOUTLET ASSEMBLIES

A. Manufacturers:

1. Multioutlet Assemblies:

   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Walker/Wiremold Company (The).
   c. Thomas & Betts/Steel City Corporation.
   d. Or approved equal as determined by the Engineer.

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: Aluminum/Satin.

C. Wire: No. 12 AWG.

D. Devices: 15 amp, 125 volt simplex receptacles on 6” centers the entire length of the raceway.

E. Verify mounting height with architect.

2.11 TELEPHONE/POWER POLE ASSEMBLIES

A. Manufacturers:

1. Telephone/power pole assemblies:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Walker/Wiremold Company (The).
c. Thomas & Betts/Steel City Corporation.
d. Or approved equal as determined by the Engineer.

B. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.

1. Poles: Nominal 2.25-inch- (57-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment. Verify ceiling height with Architect.
3. Finishes: Aluminum/Satin.
4. Wiring: Sized for minimum of fifteen No. 12 AWG power and ground conductors; and a minimum of fifteen, 4-pair, Category 6 voice and data communication cables.
5. Power Receptacles: Multiple, as indicated duplex, 20-A, heavy-duty, NEMA WD 6, Configuration 5-20R units.
6. Voice and Data Communication Outlets: Multiple RJ-45 voice/data jacks, as indicated.

2.12 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: GRC or IMC.

2. Concealed: GRC or IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R.

B. Indoors:

1. Panelboard/Switchboard/Switchgear Feeders: EMT overhead or RNC underground.
2. Exposed in unfinished areas: GRC or IMC where subject to physical damage (such as conduit installed on floors or up to a surface mounted device or panel from underground) otherwise EMT.
3. Exposed in finished areas (where existing wall prohibits fishing conduit down the walls): Non- Metallic surface raceway with surface raceway style boxes. EMT conduit with standard 4″ square boxes is not allowed, unless otherwise directed in the field.
4. Elevator pits: GRC or IMC with FS type boxes.
5. Concealed in metal stud partition: EMT.
6. Concealed in masonry partition: EMT or RNC.
7. Concealed in wood partition: EMT or RNC.
8. Concealed above finished ceiling: EMT.
9. Underground or in Bedding Material: RNC.
10. Concealed within Concrete Slab: RNC or EMT with compression fittings where subject to space limitations only.
11. Connection to Vibrating Equipment such as Transformers and Fan Equipment): FMC; except use LFMC in damp or wet locations.
12. Connection to Vibrating Equipment such as Pump Equipment): LFMC.
13. Connection to from one individual junction box to one individual lighting fixture: FMC or MC.
14. Damp or Wet Locations: GRC or IMC.
15. Tight to Bottom of Roof Deck: GRC or IMC.
16. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

    a. Damp or Wet Locations: NEMA 250, Type 3R.

C. Minimum Indoor Non-Flexible Raceway Size: 3/4-inch trade size (DN 20). Minimum Outdoor Raceway Size: 1-inch trade size (DN 25). Obey these dimensions despite what might be indicated on the panelboard schedules on the drawings.

3.2 INSTALLATION

A. The use of MC cable (for other than light fixture whips) shall have written authorization by the Engineer.

B. Electrical raceways shall be supported independently from any other trade’s supports or existing supports to the structure. E.C. shall provide strut as required between beams or bar joists that span between a required support location. E.C. shall provide strut as required underneath elements such as ductwork to independently support their electrical equipment, such as light fixtures.

C. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

D. Complete raceway installation before starting conductor installation.

E. Support raceways as specified in Section 260529 "Hangers and Supports for Electrical Systems".

F. Install temporary closures to prevent foreign matter from entering raceways, boxes, panels, light fixtures, smoke detectors, etc. during construction. Provide duct tape over masonry rough-in boxes during construction to prevent mortar and other debris from entering box. Remove all temporary protection for final device trim out and when the job conditions are conducive.

G. Protect stub-ups from damage where conduits rise through floor slabs. Coordinate depth of conduits penetrating above/below footings with the structural drawings to ensure proper bend radius when conduit turns up through floor. Arrange so that no part of the bend in the conduit shall be visible from above the floor.

H. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. Notify Architect and Engineer prior to installation if conduit or boxes are to be exposed, other than that shown on the drawings.

J. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover, when available.

   1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   2. Space raceways laterally to prevent voids in concrete.
   3. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   4. Change from nonmetallic tubing to GRC or IMC before rising through the floor (such as an underground conduit homerun to a panelboard).
   5. Utilize ½″ EMT with compression fittings only where dictated by concrete pour space limitations, upon pre-approval of the Engineer.

K. Change from nonmetallic tubing to GRC or IMC before rising above grade to a utility pole.

L. Install exposed and concealed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

   1. Run parallel or banked raceways together on common supports.

2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

M. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

N. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two heavy-duty locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Label pull wire at origination end (i.e. cable tray or panelboard).

P. Pull or Junction Boxes: Install raceways in maximum lengths of 150 feet (45 m). Install telecommunication conduits with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes, along with access panels if required, where necessary to comply with these requirements.

Q. Non-Hazardous Locations: Install raceway seal-off fittings at suitable, approved, and accessible locations and fill them with UL-listed ductseal compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces and penetrations outside of building including roof.
2. Where otherwise required by NFPA 70.

R. Hazardous Locations: Install raceway seal-off fittings at suitable, approved, and accessible locations and fill them with UL-listed “Chico” or equal sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from one Class and Division location to another.
2. Where otherwise required by NFPA 70.

P. Stub-up Connections: Extend conduits through concrete floor for connection to surface mounted or freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conduits to the equipment (such as surface mounted panelboards) with rigid steel conduit; LFMC may be used 6 inches (150 mm) above the floor to vibrating equipment. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections. When transitioning up from underground slab on grade below to above grade (whether exposed or concealed), provide rigid steel conduit ells.

Q. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations and connections to pumps. Install separate ground conductor across flexible connections. Tie up flexible conduit light fixture whips above ceiling with metal clips such as made by Caddy or tie wire to the structure so that it does not rest on the ceiling.

R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Verify mounting height with architect on all surface raceways prior to rough-in. All surface raceways are to be supported a minimum of every eight (8) linear inches with one anchor for single compartment raceway and two separate anchors for dual compartment raceway. Where surface raceways butt up against each other at an intersecting wall or around a column, Contractor shall use factory internal and external radius fittings and not stop the raceways and butt them up against each other.

S. Floor Boxes and Poke-Through Assemblies: Set units level and flush with finished floor surface. Verify exact locations with Architect/Owner prior to rough-in. Do <u>not</u> scale locations from the drawings. Adjust locations of floor service outlets, poke-through assemblies, service poles, and associated service pole junction boxes to suit arrangement of partitions and furnishings. Provide either cast iron or PVC floor boxes for devices on a grade floor. Provide poke-through assemblies for boxes on floors above grade. Where a poke-through assembly(ies) cannot be provided to accomplish the task, a stamped steel floor box may be provided in this instance. E.C. shall provide rough opening sizes to G.C. for them to box out for floor boxes installed above grade. Provide all required firestopping, additional gypsum board, rockwool, etc. for boxes/poke-throughs above finished floor to retain the fire rating of the floor. Provide core-drilled opening in concrete floor for poke-through assemblies at the diameter recommended by the poke-through manufacturer. Coordinate with the Architect and Structural Engineer prior to installation of any floor boxes or poke-throughs installed in existing concrete floors for structural integrity or coordination of any existing post stress rebar concealed within floors. Install floor boxes and poke-throughs on 24″ minimum centers per UL requirements. Coordinate any further spacing requirements with Structural Engineer. E.C. shall coordinate audio/visual and voice/data/video jacks/connectors supplied by others with floor box and/or poke-through assembly manufacturer for compliance.

T. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

U. Separate raceways: Provide separate raceways for conductors of different voltage systems (i.e. 480/277 volt versus 208/120 volt versus sub 100 volt systems). Provide separate raceways, including fixture whip drops, for the normal power and emergency power systems.

V. Burial Depth: Exterior branch circuit conduits in grassy areas shall have a minimum cover of 18 inches (457 mm). Exterior feeder and service entrance conduits in grassy areas shall have a minimum cover of 36 inches (914 mm). Exterior conduit ductbanks encased in concrete shall have a minimum cover of 30 inches (762 mm). Coordinate burial depths with contour lines and new elevations indicated on the drawings.

W. In general, all conduits passing under concrete or asphalt roads, parking lots, driveways, etc. and service entrance conduits shall be encased in concrete. Refer to the drawings for other exact locations of concreted encased ductbanks.

X. Conduit Fittings: The use of condulets shall minimized. Provide cast iron body and gasketing for all exterior uses and aluminum and gasketing for all interior uses. Where necessary to use condulets sized above 2”, mogul units shall be installed. Notify Engineer prior to installation. The use of conduit pulling fittings is not permitted. A short 180 degree “u-shaped” bend between two adjacent rough-in boxes is not an acceptable solution.

Y. Service entrance conduit penetrations and entrances into buildings to be in galvanized steel, heavy wall conduit. Transform from non-metallic ducts to steel at a minimum of 10 feet from building. Use fittings manufactured for the purpose.

Z. Concrete-encased conduits to have reinforcing steel when passing through excavations and disturbed earth. Coordinate duct bank with structural design at wall so duct bank is supported at wall without reducing structural or watertight integrity.

AA. Non-encased, direct buried exterior conduits entering non-waterproofed walls to have a galvanized, heavy wall steel pipe sleeve for each duct installed by the Electrical Contractor. Caulk sleeve between sleeve and conduit with duct sealing compound on both sides for moisture-tight seal, to satisfaction of Architect.

BB. Where exterior conduits enter a building or structure through a waterproofed floor or wall or below grade, provide a watertight entrance-sealing device, with sealing gland assembly on the inside. Refer to Section 260500 "Common Work Results for Electrical" for information regarding these sleeves. Device to be securely anchored into the masonry construction with one or more integral flanges and membrane waterproofing secured to the device in a permanently watertight manner.

CC. Where conduits are indicated to be non-metallic, stub-ups to be galvanized heavy wall steel and to extend 5 feet away from pad or

equipment. Encase with 3-inch concrete envelope. Provide insulating bushings on stubs.

DD. Provide temporary closure at all ends of exterior conduits which are to be active. Spare exterior conduits to have permanent seals at all openings, to allow for future use. Sealing compound and plugs to withstand 15 psi minimum hydrostatic pressure.

EE. Deliver conduits to site with ends capped, and store with supports to prevent bending, warping and deformings.

FF. Wireways: Provide metallic wireways for all indoor dry applications. Provide non-metallic wireways for all outdoor, wet, or corrosive environment locations.

GG. Where a conduit penetrates a wall and must be terminate at a surface mounted junction box, the junction box shall not be located off of the wall the depth of the conduit connector or more. The vertical conduit shall be terminated in a flush junction box and the box shall be brought out to the surface with (an) extension ring(s) for continuation of the conduit. Junction boxes that are spaced off a wall more than the length of a conduit connector are not acceptable, unless structural conditions do not permit this installation.

HH. Maintain 3″ minimum spacing between conduits in a ductbank and between conduits and the edge of the ductbank with PVC intermediate spacers. Maintain 3″ minimum spacing between the lowest row of conduits in a ductbank and the earth with PVC base spacers. Conduits and PVC spacers shall be securely anchored during concrete placement in a ductbank to prevent movement through the use of rebar and non-metallic fasteners such as nylon zip ties. Provide spacers to prevent sags in conduit at least every 10 feet.

II. Secure vertical conduits along wall entering or exiting distribution equipment through the use of strut and strut straps.

JJ. Coordinate any floor and wall penetrations through existing walls with Owner prior to installation. Coordinate any floor and wall penetrations through new walls with Architect and Structural Engineer prior to installation. Provide steel lintels for wall openings 24 inches wide or greater.

KK. Where conduits of any type pass over a building expansion joint, a standard “expansion joint fitting,” compatible with the type raceway being used, shall be provided.

LL. Waterproof marking cord with 130 lb tensile strength and marked every ten feet shall be installed in all exterior underground ducts, including spares, after thoroughly rodding, clearing, and swabbing all lines free of any and all obstructions.

MM. Exterior underground ducts shall be sealed at terminations, using sealing compound and plugs, as required to withstand 15 psi minimum hydrostatic pressure.

NN. All electrical devices shall be mounted to an approved electrical rough-in box, unless otherwise noted.

OO. Junction boxes suspended more than 36″ from a wall or ceiling, require a dedicated minimum ¼″ all thread support to the structure.

PP. Obey the NEC for all minimum conduit support distances.

QQ. Flexible conduit installed above ceilings for light fixture whips shall not touch the ceiling grid and shall be supported by the use of a caddy clip or tie wire.

RR. For all exterior conduits mounted on flat rubber roofs or ran along ground in aggregate base (such as a mechanical courtyard), provide 4″ x 4″ wood blocking with rubber bases or Styrofoam blocking with insert for strut support at a maximum of every 7 feet for each conduit support and secure conduit to blocking with two hole conduit strap on wood block or strut strap on Styrofoam blocking.

SS. Provide Caddy or equal type metallic box supports between metal studs for supporting of electrical boxes rigidly on both sides, in lieu of securing box only on one side with right angle Caddy or equal type box support.

TT. Provide Caddy or equal type “through the stud conduit support” with two screw fasteners for all conduits routed through metal stud openings, both horizontal and vertical, to eliminate conduit rattle.

UU. All conduit shall be rigidly supported with either one hole straps, two hole straps, minerallac straps, strut straps, etc. Conduit shall not be supported with tie wire, ceiling wire, or tape.

VV. The electrical drawings do not specifically indicate gypsum board thickness or wall thickness. The Contractor shall coordinate and provide all required plaster rings, masonry rings, extensions, etc. for a flush outlet box rough-in with the wall thickness.

WW. Provide flanged coverplate for all recessed screw cover or hinged cover junction boxes in wall that is at least 1″ larger than the junction box itself in all four directions to conceal the gap around the junction box opening (i.e. A/V junction boxes). Caulk and paint around coverplate and wall with materials to match adjacent wall finish.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

B. Wipe down all exposed surface raceways.

C. Clean out all floor boxes for dust and debris.

D. Rod all underground conduits with a mandrel 1/4-inch smaller in diameter than the internal diameter of respective duct, prior to backfill. Remove any indicated obstructions.

END OF SECTION 26 05 33

SECTION 26 05 90
ELECTRICAL TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes general requirements for electrical field testing and inspecting. Detailed requirements are specified in each Section containing components that require testing. General requirements include the following:

1. Qualifications of testing agencies and their personnel.
2. Suitability of test equipment.
3. Calibration of test instruments.
4. Coordination requirements for testing and inspecting.
5. Reporting requirements for testing and inspecting.

1.3 QUALITY ASSURANCE

A. Test Equipment Suitability: Comply with NETA ATS, Section 5.2.

B. Test Equipment Calibration: Comply with NETA ATS, Section 5.3.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 GENERAL TESTS AND INSPECTIONS

A. An operating test of the complete electrical system shall be made. System shall test free from grounds, shorts and other faults. Connections shall be for positive mechanical and electrical connection and continuity. Equipment shall be demonstrated to operate in accordance with the requirements of the plans and specifications. Contractor shall furnish all personnel and test instruments required. Performance of tests shall be made in the presence of the Architect, Engineer, or Owner's representative if so requested.

B. Correct situations to obtain required results. Include the following tests as appropriate:

1. Check all wire terminals and clean connections.
2. Check all control switches, alarm devices, indicating instruments for proper operation under normal and simulated abnormal conditions.
3. Perform insulation-resistance tests on all 600 V and below phase and neutral service entrance conductors, feeders, and motor

circuits with a 500 V megger prior to energizing. Minimum readings shall be 1,000,000 ohms for #6 AWG, 600 V wire and smaller and 250,000 ohms for #4 AWG, 600 V wire and above. Readings shall be taken between phase conductors and between phase conductors and ground.

4. After all fixtures, devices, and equipment are installed and all connections completed to each panel, the Contractor shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and the grounded enclosure. If this reading is less than 250,000 ohms, the Contractor shall disconnect the branch circuit neutral wires from this neutral bar. They shall then test each one separately to the panel and until the low readings are found. The Contractor shall correct troubles, until the low readings are found. The Contractor shall correct troubles, reconnect and retest until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.
5. Perform grounding resistance measurements at the service as required in specification section 260526.
6. Perform conductor continuity tests.
7. Perform rotation tests for all motors.
8. Provide a stable source of single-phase, 208/120-V electrical power for test instrumentation at each test location.
9. Perform low voltage systems tests as required in the respective systems specification sections.
10. Perform lighting foot-candle readings in designated areas, when requested by Engineer.
11. Perform 5 mA ground fault tests on all GFCI devices with approved GF tester. For adjustable ground fault circuit breakers, acquire and adjust settings based on coordination study.
12. Perform tests on all receptacles for polarity, continuity, etc. with approved receptacle tester.
13. Operate each circuit breaker and disconnect manually.
14. Provide transformer, transfer switch, motor controller, and switchgear testing as required in the corresponding specification sections.
15. Test all “life safety” equipment and systems for proper function and operation. Upon successful completion of tests, confirmation shall be sent to the Engineer of Record, and the State Fire Marshal’s Office in the form of a letter stating the tests performed, the results, and the date tests were successfully complete. “Life Safety” equipment and systems consist of those as specified in NFPA 101, NFPA 99, and the State Building Code (Fire Alarm and Emergency Power Systems).

C. Test and Inspection Reports: In addition to requirements specified elsewhere, report the following:

1. Manufacturer's written testing and inspecting instructions.
2. Calibration and adjustment settings of adjustable and interchangeable devices involved in tests.
3. Tabulation of expected measurement results made before measurements.
4. Tabulation of "as-found" and "as-left" measurement and observation results.
5. Upon completion of work, Contractor shall send a letter to the Architect certifying that these tests have been accomplished.

During field visits, Contractor shall demonstrate installation and make such tests as may be required to satisfy the Architect/Engineer and Owner that work is installed in accordance with drawings, specifications and instructions.

6. Provide copy of all test results, with signature of Contractor, date of each test, time of day of each test, temperature and weather conditions at time of each test, test equipment make, model, and serial number for each test, all in the Operations and Maintenance manuals.

END OF SECTION 26 05 90

SECTION 26 09 24
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 26 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes networkable, automatically and manually operated lighting control panels with relays, control modules and the following lighting control devices:

1. Indoor occupancy sensors.
2. Low voltage control stations.
3. Momentary override switches.
4. Dimmer controls.

B. Related Sections include the following:

1. Section 23 “HVAC Instrumentation and Controls” for integration with central time based BAS system panel.
2. Section 26 "Interior Lighting" for lighting control coordination.
3. Section 26 "Exterior Lighting" for lighting control coordination.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

C. US: Ultrasonic.

D. DT: Dual technology.

E. BACnet: A networking communication protocol that complies with ASHRAE 135.

F. BAS: Building automation system.

G. DALI: Digital addressable lighting interface.

H. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

I. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

J. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power

quality evaluation data, event and alarm signals, tabulated reports, and event logs.

K. PC: Personal computer; sometimes plural as "PCs."

L. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.

M. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

1.4 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

1. C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. ASTM International (ASTM) ()

1. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.

C. Canadian Standards Association (CSA) ().

1. CSA C22.2 # 14 Industrial Control Equipment
2. CSA C22.2 # 184 Solid-State Lighting Controls

D. International Electrotechnical Commission ().

1. (IEC) 801-2 Electrostatic Discharge Testing Standard.
2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.

E. International Organization for Standardization (ISO)

1. 9001:2000 – Quality Management Systems.

F. National Electrical Manufacturers Association (NEMA)

1. WD1 (R2005) - General Color Requirements for Wiring Devices.

G. Underwriters Laboratories, Inc. (UL) ():

1. 20 (2002) - Standard for Safety for General-Use Snap Switches.
2. 508 (1999) - Standard for Industrial Control Equipment.
3. 924 (2003) - Emergency Lighting and Power Equipment

1.5 SUBMITTALS

A. Product Data: For each type of product indicated herein including: input devices, panels, control modules, wiring diagrams, conductors

and cables, provide catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

B. Specification Conformance Document: Indicate whether the submitted equipment either:

1. Meets specification exactly as stated.
2. Meets specification via an alternate means and indicate the specific methodology used.

C. Shop Drawings: Show wiring and installation details for all components specific to this project.

1. Lighting plan showing location, orientation, and coverage area of each sensor.
2. Power, signal, and control wiring diagrams of each device and how it interconnects with the panels and fixtures.
3. Interconnection diagrams showing field-installed wiring vs. factory wiring.
4. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
5. Block Diagram: Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
6. Load schedule of connected load, load type, voltage, circuit numbers, devices, wiring, zoning, and fixtures per area.

D. Coordination Drawings: Submit evidence that lighting controls in this Section are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

G. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

H. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of lighting control functions.
2. Coordinate lighting controls with BAS. Design display graphics showing building areas controlled; include the status of lighting controls in each area.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Failure of software input/output to execute switching or dimming commands.
    b. Failure of modular relays to operate under manual or software commands.
    c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: Two years from date of Substantial Completion.
3. Extended Warranty Period Failure Due to Transient Voltage Surges: Eight years.
4. Extended Warranty Period for Electrically Held Relays: 10 years from date of Substantial Completion.
5. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.
6. Make new replacement parts available for minimum of ten years from date of manufacture.
7. Provide factory direct technical support hotline 24 hours per day, 7 days per week.
8. Provide on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

1.9 COMMISSIONING

A. Provide factory-certified field service engineer to make site visits to ensure proper system installation and operation under following parameters:

1. Qualifications for factory-certified field service engineer:

   a. Minimum experience of 2 years training in the electrical/electronic field.
   b. Certified by the equipment manufacturer on the system installed.

2. Make visits upon completion of installation of lighting control system:

   a. Verify connection of power feeds and load circuits.
   b. Verify connection and location of controls.
   c. Work alongside the Mechanical Controls Contractor to ensure that all the lighting circuits are programmed and working properly through the BAS.
   d. Verify proper connection of panel links (low voltage/data).
   e. Check load currents and remove by-pass jumpers.
   f. Verify system operation control by control, circuit by circuit.
   g. Verify proper operation of manufacturers interfacing equipment.
   h. Obtain sign-off on system functions.
   i. Users to be trained on system operation.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Electrically Held Relays: Equal to ten percent of amount installed, but no fewer than one relay of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Centralized Lighting Control Panel Basis-of-Design Product: Subject to compliance with requirements, provide Lutron Softswitch 128 or comparable product by one of the following:

1. Hubbell.
2. Leviton.
3. Wattstopper (The).
4. Or approved equal as determined by the Engineer.

B. Localized Lighting Control Peripheral Products: Refer to the individual paragraphs for manufacturers.

2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449 3nd Edition, where indicated.

2.3 LOCALIZED INDOOR OCCUPANCY SENSORS (OPERATING INDEPENDENTLY OF THE CENTRALIZED LIGHTING CONTROL SYSTEM)

A. Manufacturers:

1. Hubbell Building Automation.
2. Leviton.
3. Lutron.
4. RAB.
5. Sensor Switch, Inc.
6. Watt Stopper (Basis of Design).
7. Or approved equal as determined by the Engineer.

B. General Description: Wall- or ceiling-mounting, solid-state units as indicated on drawings that work independently of the centralized lighting control system. All ceiling mounted occupancy sensors require a separate power/switch pack.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit. Provide spare set of contacts as a control point for Building Automation System.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted though a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the ON function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (215 to 2150 lx); keeps lighting off when selected lighting level is present.
8. Include ground wire.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch (150-mm) minimum movement of any portion of a human body that presents a target of at least 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27 m) when mounted on a 10-foot- (3-m-) high ceiling.

D. Ultrasonic (US) Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Detector Sensitivity: Detect a person of average size and weight moving at least 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on an 8-foot- (2.4-m-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

E. Dual-Technology (DT) Type: Ceiling mounting; detect occupancy by using a combination of PIR and US detection methods in area of coverage. Particular technology or combination of technologies that controls ON and OFF functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch (150-mm) minimum movement of any portion of a human body that presents a target of at least 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving at least 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.4 LOCALIZED DIMMER CONTROLS (OPERATING INDEPENDENTLY OF THE CENTRALIZED LIGHTING CONTROL SYSTEM)

A. Single or multi-location applications.

B. Wall plate, ganged at multi unit locations.

C. Power failure memory.

D. Line frequency compensation.

E. Surge protection and heavy duty components for a long product life.

F. Electrostatic discharge protection.

G. Captive tapswitch and rocker.

H. Front accessible service switch to disconnect load power.

I. Includes radio frequency interference suppression circuitry.

J. Fluorescent Lamp Dimmer Switches: Modular; must be compatible with associated ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

K. Master Dimmer: Lutron #SPSF-6AM-277 or equal.

L. Remote Accessory Dimmer: Lutron #SPS-AD-277 or equal.

2.5 CENTRALIZED LIGHTING CONTROL PANEL - SYSTEM REQUIREMENTS

A. BAS Interface: Provide hardware and software to enable the BAS to monitor, display, and record data for use in processing reports.

1. LonWorks, RS232, and Contact closure input / Contact closure output communication interface with the BAS shall enable the BAS operator to remotely monitor lighting from a BAS operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the BAS. Coordinate exact communication requirements with Mechanical Contractor.

2.6 CENTRALIZED LIGHTING CONTROL PANEL - GENERAL

A. Provide hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

B. Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0° C (32°F) to 40° C (104°F) and 90 percent non-condensing relative humidity.

C. Designed and tested to withstand electrostatic discharges up to 15,000 V without impairmentper IEC 801-2.

2.7 CENTRALIZED LIGHTING CONTROL PANEL - PERFORMANCE REQUIREMENTS

A. Electrolytic capacitors to operate at least 20° C below the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40° C (104° F) ambient temperature.

B. Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of dimmer/relay.

C. Design and test relays to withstand line-side surges without impairment to performance.

1. Panels: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41B.

D. Utilize air gap off, activated when user selects “off” at any control to disconnect the load from line supply.

E. Possess power failure memory such that if power is interrupted and subsequently returned, lights will automatically return to same levels (on or off) prior to power interruption within 3 seconds.

F. Non-dim circuits to meet the following requirements:

1. Rated life of relay: Minimum 1,000,000 cycles.
2. Load switched in manner that prevents arcing at mechanical contacts when power is applied to load circuits.
3. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

2.8 CENTRALIZED LIGHTING CONTROL PANEL - POWER COMPONENTS

A. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.

1. Cabinet: Steel with hinged, locking door.

a. Barriers separate low-voltage and line-voltage components.
b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.

2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.

a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
c. Endurance: 1,000,000 cycles at rated capacity.
d. Mounting: Provision for easy removal and installation in relay cabinet.

B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels.

2.9 CENTRALIZED LIGHTING CONTROL PANEL - LCD PROCESSOR

A. System to be password protected.

B. Language selection: English.

C. Integral contact closure inputs.

D. Programming and system operation:

1. Control stations, control interfaces, and contact closure inputs

   a. Assign functionality of each control station button or infrared interface.

      1. Select patterns
      2. Select customized pattern
      3. Enable/Disable time clock
      4. Initiate delay to off
      5. Toggle one, some, or all zones

   b. RS232 interface or Ethernet interface
   c. Contact closure output: Momentary or maintained

2. No time clock (controlled via BAS system)

3. Overrides:

   a. Set circuit status
   b. Select pattern
   c. Time clock override
   d. Control station overrides
   e. After-hours override

2.10 CENTRALIZED LIGHTING CONTROL PANEL - DIAGNOSTICS AND SERVICE:

A. Replacing relay does not require re-programming of system or processor.

B. Relays: Include diagnostic LED’s to verify proper operation and assist in system troubleshooting.

C. Relay panels: Include tiered control scheme for dealing with component failure that minimizes loss of control for occupant.

1. If lighting control system fails, lights to remain at current level. Panel processor provides local control of lights until system is repaired.
2. If panel processor fails, lights to remain at current level. Circuit breakers can be used to turn lights off or to full light output, allowing non-dim control of lights until panel processor is repaired.
3. If relay fails, factory-installed mechanical bypass jumpers to allow each relay to be mechanically bypassed. Mechanical bypass device to allow for switching operation of connected load with relay removed by means of circuit breaker.

2.11 CENTRALIZED LIGHTING CONTROL PANEL - LOW VOLTAGE CONTROL INTERFACES

A. Contact Closure Interfaces:

1. Where contact closures are used to integrate between lighting controls and other systems:

   a. Input open circuit voltage not to exceed 36V.
   b. Input short circuit current not to exceed 0.5 mA.
   c. Mechanical contact closures to be dry contact rated.
   d. Solid state contact closures:

      1. Output off-state leakage current not to exceed 50mA.
      2. Output on-state saturation voltage not to be less than 2V.

   e. The contact closure input device will accept both momentary and maintained contact closures.

B. RS232 Interfaces:

1. Provide ability to communicate by means of RS232 serial communication Softswitch 128 system by means of user-supplied PC or digital audiovisual equipment. Control to be located within 50 feet (15 meters) of RS232 source.

2. Provide access to:

   a. Pattern selections.
   b. Control individual zones.
   c. Enable/disable time clock.
   d. Setting of time clock.
   e. Enable/disable wall station.
   f. Simulate wall station button press.
   g. Reading/setting of system variables.

3. Provide status monitoring through button feedback and pattern-status updates.

C. Ethernet Interfaces:

1. Provide ability to communicate by means of TCP/IP over Ethernet to Softswitch128 system by means of user-supplied PC or digital audiovisual equipment. Control to be located within 300 feet (100 meters) of Ethernet source.

2. Provide access to:

   a. Pattern selections.
   b. Control individual zones.
   c. Enable/disable time clock.
   d. Setting of time clock.
   e. Enable/disable wall station.
   f. Simulate wall station button press.
   g. Reading/setting of system variables.

3. Provide status monitoring through button feedback and pattern-status updates.

D. LonWorks Interface:

1. Provide ability to communicate by means of LonWorks FTT-10 communication to centralized lighting system from user-supplied LonWorks FTT-10 twisted pair network.

2. Provide LonWorks interface object model specification to secondary equipment manufacturers.

2.12 LOW VOLTAGE CONTROL STATIONS (WORKING IN CONJUNCTION WITH THE CENTRALIZED LIGHTING CONTROL PANEL)

A. Manufacturers:

1. Lutron #SO series.
2. Or approved equal as determined by the Engineer.

B. Description:

1. Backlit, large rounded buttons that can be engraved and are easy to use.
2. Use RS485 wiring for low voltage communication.
3. Upon button press, LEDs to immediately illuminate.
4. LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or the LEDs turn off if the button press was not processed.
5. Allow for easy reprogramming without replacing unit.
6. Replacement of units does not require reprogramming.
7. Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.
8. Engrave wall stations with appropriate button, zone, and scene engraving descriptions furnished prior to fabrication.
9. Provide faceplates with concealed mounting hardware.
10. Silk-screened borders, logos, and graduations to use graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.

2.13 MOMENTARY OVERRIDE SWITCHES (WORKING IN CONJUNCTION WITH THE CENTRALIZED LIGHTING CONTROL PANEL)

A. Manufacturers:

1. Sentry #SS series.
2. Or approved equal as determined by the Engineer.

B. Description:

1. Coordinate voltage and ampacity of switch with manufacturer.
2. Provide single pole or three way switches as required.
3. Standard wall switch on/off operation.
4. Toggle style.
5. Mechanically resets to “off” automatically when input power to the unit is interrupted for five seconds or longer.
6. Mini neon locator light illuminates when unit is switched off.
7. Strap mount device mounts in single or multi-gang wallbox.

8. Uses standard wallplates, not included with unit.
9. When used with occupancy sensors, eliminates false triggering.
10. Line voltage.
11. Must coordinate with associated lighting control system.

2.14 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Section 26 "Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Section 26 "Conductors and Cables."

C. Class 1 Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Section 26 "Conductors and Cables."

PART 3 - EXECUTION

3.1 OCCUPANCY SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. Do not install occupancy sensors within line of site of adjacent space visible through a doorway.

C. Do not install ceiling mounted occupancy sensors within six (6) feet of an air diffuser or grill.

D. All occupancy sensors and power packs shall be mounted to a junction box with plaster/mud ring. Provide t-bar support for rough-in box in lay-in ceilings. Grid ceiling mounted sensors shall be centered in the ceiling tile.

3.2 OCCUPANCY SENSOR TYPES

A. Standard Enclosed Offices, Standard Conference Rooms, Storage Rooms, Aisles/Stacks: PIR

B. Large Conference Rooms, Classrooms: DT

C. Open Office Plan, Corridors, Stairwells, Restrooms: US

D. Consult Engineer for areas not mentioned, but shown on the drawings.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Section 26 "Conductors and Cables."

B. Comply with NECA 1.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Wiring Method: Install wiring in raceways. Comply with Section 26 "Conductors and Cables". Minimum conduit size shall be 3/4 inch.

E. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

F. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

G. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

H. Identify components and power and control wiring according to Section 26 "Identification for Electrical Systems."

I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

J. If a toggle switch is being provided on the wall along with a ceiling mounted occupancy sensor, then wire the toggle switch downstream of the ceiling power/switch pack and upstream of the lighting switchleg circuit. The power/switch pack shall constantly remain energized, but the lights will not be energized until the toggle switch is in the ON position and there is movement in the space.

K. Provide 120 Volt control power to all contactor coils, time clocks, photocells, and OS power packs, whether or not indicated on the drawings. For emergency egress lighting circuits driven by a lighting control system, provide emergency control power.

L. All low voltage wiring shall be installed in conduit.

M. Install unshared dedicated neutral conductors on line and load side of dimmer controls.

N. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

O. Group common dimmers under a single, multi-gang wall plates, whether or not indicated on drawings.

P. Interconnect all centralized lighting control panels together for a network application.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 "Electrical Identification."

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Test for circuit continuity.
2. Verify that the control module features are operational.
3. Check operation of local override controls and programmed zones.
4. Test system diagnostics by simulating improper operation of several components selected by the Commissioning Agent.

C. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

D. Operational Test: Verify actuation of each sensor and adjust time delays.

E. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

B. Initial Setting: Set the time delay on all occupancy sensors to 30 minutes minimum, unless otherwise directed. Confirm actual settings with Owner in the field.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, program, and maintain lighting controls. Refer to Section 26 "Basic Electrical Requirements."

END OF SECTION 26 09 24

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

B. Related Sections include the following:

1. Section 260526 "Grounding and Bonding for Electrical Systems" for additional grounding specification items.
2. Section 262813 "Fuses" for additional fuse requirements when integral to panelboards.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. LIM: Line Isolation Monitor.

D. RFI: Radio-frequency interference.

E. RMS: Root mean square.

F. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard indicate the accessories and components as noted on drawings or these specifications and place in alphabetical order of the designation name. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. The layout of overcurrent protection devices shall be in accordance with the schedules shown on the drawings, in lieu of manufacturer’s standard layouts.

2. Provide ¼” scale plan view drawings of each electrical room indicating all switchgear, concrete pads, feeders, and electrical equipment to verify NEC and manufacturer specific required clearances. Lack of submission of these coordination drawings at the time of shop drawing submittals relieves Engineer from future coordination issues.

3. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

   a. Enclosure and cover types, mounting types, and details.
   b. Grounding bars.
   c. Nametags (not standard manufacturer’s type).
   d. Panelboard layout diagrams.
   e. Bus configurations, bus material, current, voltage, phase, wire ratings.
   f. Short-circuit current full rating of panelboards and overcurrent protective devices.
   g. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

4. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260529 “Hangers and Supports for Electrical Systems”. Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition

to items specified in Section 260500 "Common Work Results for Electrical," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Section 260100, "Basic Electrical Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 260500 “Common Work Results for Electrical.”

C. Coordinate erection of recessed panelboards with wall erection. Coordinate erection of wall mounted panelboards with priming and painting of walls.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Six spares for each type of panelboard cabinet lock.

1.9 ELECTRICAL IDENTIFICATION

A. Refer to Section 260553 “Identification for Electrical Systems” and the drawing details for non-standardized nametag information.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Eaton Corporation; Cutler-Hammer Products.
b. Siemens Energy & Automation, Inc.
c. Square D (basis of design).
d. Or approved equal as determined by the Engineer.

2.2 MANUFACTURED UNITS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260529 “Hangers and Supports for Electrical Systems”.

B. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R.
b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
5. Directory Card: Typewritten or computer generated card with transparent protective cover, mounted in metal frame or plastic frame, inside panelboard door.

C. Phase and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Equipment Ground Bus: Adequate capacity and size to accommodate all feeder and branch-circuit equipment ground conductors; bonded to box.
3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus (unless otherwise noted) and UL listed as suitable for nonlinear loads, where indicated on drawings. Adequate capacity and size to accommodate all feeder neutral conductors, where indicated on drawings.

D. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs and Bus Configured Terminators: Mechanical type.
3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
4. Sub-Feed Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
5. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs (unless otherwise noted) mounted on extra-capacity neutral bus.

E. Service Equipment Label: UL labeled for use as service equipment for panelboards, when utilized as such.

F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: Dead-front, secured with vault-type latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Thermal-magnetic, molded-case, bolt-on circuit breaker.

C. Branch Overcurrent Protective Devices:

1. For Circuit-Breakers: Thermal-magnetic, molded-case, bolt-on circuit breakers. Branch circuit breakers shall be rated at 80%, unless otherwise noted.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Thermal-magnetic, molded-case, bolt-on circuit breakers, replaceable without disturbing adjacent units. Branch circuit breakers shall be rated at 80%, unless otherwise noted.

B. Doors: Hinged door within hinged door; secured with screw fasteners and with flush latch and tumbler lock; keyed alike.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity. Provide GFCI circuit breakers for all of the following whether or not indicated on the drawings: electric water coolers, heat trace, ice machines, and receptacles near water sources such as sinks.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment loads. Confirm breaker listings with circuiting.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. Provide as indicated on the drawings.
4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage. Provide as indicated on the drawings.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay. Provide as indicated on the drawings.
6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts. Provide as indicated on the drawings.

7. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Section 260529 “Hangers and Supports for Electrical Systems”.

C. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges under direction of Engineer.

F. Install filler plates in unused spaces.

G. For flush panelboards, stub 3/4-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub ¾-inch empty conduits into raised floor spaces. Provide spare conduit quantities equal to the number of single pole spares and spaces divided by three.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

I. Provide a copy of the as-built electrical one line diagram in a clear glass frame next to the main service entrance panel.

J. Provide a 1” conduit from the panelboard meter (if applicable) to the BAS system.

K. Surface mounted panelboards can be installed on stand off strut as long as all clearances are maintained.

L. All spare circuit breakers shall be left in the OFF position.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Schedule a meeting with the Owner and obtain Owner’s final room naming and numbering scheme prior to creating directory, which may or may not match the contract drawings. Provide brief description of each circuit load and room number(s) being served

and indicate on the directory. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Revise existing panelboard schedules, as required, for a renovation project.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard supplying and exiting feeder.
2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading as best as possible.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 15 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
5. Revise panelboard directories according to any shifting of circuits.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Simplex and duplex receptacles.
2. Ground-fault circuit interrupter receptacles.
3. Single- and double-pole snap switches.
4. Device wall plates.

B. Related Sections include the following:

1. Section 260553 "Identification for Electrical Systems" for special device colors and nametag identification on device plates.
2. Section 260526 "Grounding and Bonding for Electrical Systems" for grounding connections to wiring devices.
3. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for termination of cables to wiring devices.
4. Section 260924 "Lighting Control Devices" for coordination of equipment in that section with those in this section.

1.3 DEFINITIONS

A. AFCI: Arc-fault circuit-interrupter.

B. EMI: Electromagnetic interference.

C. GFCI or GFI: Ground-fault circuit interrupter.

D. IG: Isolated Ground.

E. LED: Light-emitting diode.

F. PVC: Polyvinyl chloride.

G. RFI: Radio-frequency interference.

H. TVSS: Transient voltage surge suppressor.

I. UTP: Unshielded twisted pair.

J. Wall-Box Dimmer: A self-contained dimmer that fits into a switch box.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified, if requested.

D. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an “approved” third-party testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment or Equipment Supplied By Others: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. GFCI Receptacles: One for every 20 of each type installed, but no fewer than one of each type.
2. Wall Plates: Two for every 100 of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:

a. Hubbell Incorporated; Wiring Device-Kellems (basis of Design).
b. Leviton Mfg. Company Inc.
c. Pass & Seymour/Legrand; Wiring Devices Div.

d. Or approved equal as determined by the Engineer.

2.2 RECEPTACLES

A. All receptacles shall be listed by an “approved” third-party agency, approved for the voltage and amperage indicated. All receptacles shall be Hospital Grade.

B. Straight-Blade-Type Receptacles, General: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, UL 498, and NEMA WDI 101968. Arrange for side wiring only.

C. Straight-Blade Receptacles: Heavy-Duty hospital grade, 20amp tamper resistant safety type (i.e. Hubbell #HBL8300).

D. Grounding Type Receptacles: All receptacles shall be of the grounding type with a dedicated green grounding screw for terminating the equipment grounding conductor.

E. Rating: All receptacles are to be rated at 20 amps, unless otherwise noted.

F. GFCI Receptacles: Straight blade, non-feed-through type, Heavy-Duty duplex receptacle hospital grade (i.e. Hubbell #GFR8300, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-1/8-inch deep outlet box without an adapter.

2.3 SWITCHES

A. All switches shall be listed by an “approved” third-party agency, approved for the voltage and amperage indicated.

B. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

C. Toggle Switches: Heavy-Duty specification grade, quiet operating mechanisms (without the use of mercury switches), 20 A, 120/277-VAC, grounding type, with hex-head grounding screw (i.e. Hubbell #1221). Switches marked as commercial grade, commercial/specification grade, or specification grade (i.e. Hubbell #CSB20) are not acceptable.

D. Rocker Switches: Heavy-Duty grade, quiet type.

E. Pilot Light Switches: Heavy-Duty grade, quiet type with red LED light illuminated when load is “on”.

F. Lighted Toggle Switches: Heavy-Duty grade, quiet type with red LED light illuminated when load is “off”.

G. Keyed Switches: Heavy-Duty grade, with keyed on and off operation. Provide uniform keying system.

H. Twist Timer Switches: Mechanically spring wound, requires no electricity to operate, centered shaft, provide Decora style plate,

switch contacts shall break current carrying contacts at the end of the time cycles, 0-12 hour range, no “hold” feature.

I. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.

2.4 WALL PLATES

A. Single and combination types of standard sizes to match corresponding wiring devices. The use of jumbo plates is strictly prohibited unless otherwise directed.

1. Plate-Securing Screws: Metal with slotted oval head; color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished stainless steel 302.
3. Material for Surface Mounted Devices in Unfinished Spaces: Galvanized steel raised surface.
4. Material for Wet Location Receptacles: Thermoplastic with spring-loaded lift cover, and listed and labeled by an “approved” third-party for “wet while in use".
5. Material for Wet Location Switches: Clear rubber silicon bubble elastomer plate, and listed and labeled by an “approved” third-party for “wet while in use".
6. Material for Emergency Receptacles on Healthcare projects: Smooth, high-impact thermoplastic and satin-finished stainless steel 302, as noted above with permanent labels indicating panelboard and circuit number supplying the device. Refer to Section 260553 “Identification for Electrical Systems.”

2.5 FINISHES

A. Color:

1. Wiring Devices and Thermoplastic Cover Plates Connected to Normal Power System: Ivory, unless otherwise indicated or required by NFPA 70.
2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wiring devices and coverplates level, plumb, and square with building lines.

B. Flush mounted devices and coverplates shall be installed so that the device sticks out a minimum of 1/16” from the device plate.

C. Devices shall be mounted securely to outlet box and coverplate so that it does not move when being plugged into.

D. Install unshared dedicated neutral conductors on line and load side of dimmers and GFCI receptacles.

E. Arrangement of Devices: Unless otherwise indicated or physically impossible, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. If wall space does not permit a vertical installation, such as above a counter and/or backsplash, then mount flush, with long dimension horizontal, and with neutral terminal of receptacles on top.

F. Group common switches, receptacles, and dimmers under single, multigang wall plates, whether or not indicated on drawings.

G. Where a normal power and emergency power wiring device is located adjacent to each other, provide the same in a common backbox and with a common faceplate along with a box divider.

H. Remove wall plates and protect devices and assemblies during painting.

I. Provide GFCI receptacles at all electric water coolers, countertops with sinks, hydrotherapy tubs, ice machines, and within six feet of any water source. For non-20 amp devices, provide GFI type circuit breaker in panel instead.

J. Coordinate with respective equipment Contractor the exact NEMA configuration requirements and wire size/quantity requirements for special receptacles with cord and plugs furnished by others.

K. Where dual switching of light fixtures occurs in a common room, always install the closest switch to the door to control the inner lamps (or less quantity of lamps) and install the outer switch to control the outer lamps (or greater quantity of lamps).

L. Provide black electrical tape around wiring devices/terminals.

3.2 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

1. Emergency Receptacles: Identify panelboard and circuit number from which served. Use engraved machine printing with white-filled lettering on face of red plate, and durable wire markers or tags inside outlet boxes.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 26 27 26

SECTION 26 28 13
FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Cartridge fuses rated 600 V and less for use in disconnect switches and motor controllers.
2. Spare-fuse cabinets.

1.3 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.

B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 260500 "Common Work Results for Electrical," include the following:

a. Let-through current curves for fuses with current-limiting characteristics.
b. Time-current curves, coordination charts and tables, and related data.
c. Ambient temperature adjustment information.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Quantity equal to ten percent of each fuse type and size, but no fewer than three of each type and size.

2. Fuse Pullers: Quantity equal to ten percent of each fuse type and size, but no fewer than one of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussman, Inc.
2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
3. Ferraz Shawmut, Inc.
4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.
5. Or approved equal as determined by the Engineer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1 or UL listed, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.3 SPARE-FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- (1.27-mm-) thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses and fuse pullers specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-Line.
2. Bussman.
3. Hoffman.
4. Or approved equal as determined by the Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Service Entrance and Feeder Circuits Over 600 Amps: Class L, UL listed, dual element time delay with 200,000 Amps interrupting rating.

B. Service Entrance and Feeder Circuits Under 600 Amps: Class RK1, UL listed, dual element time delay with 200,000 Amps interrupting rating.

C. Motor, Motor Controller, and Transformer Circuits: Class RK5, UL listed, dual element time delay with 200,000 Amps interrupting rating.

D. Other Equipment or Branch Circuits Where Fault Current is Less Than 50,000 Amps: Class RK1, UL listed, dual element time delay with 200,000 Amps interrupting rating.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Coordinate location and installation of spare-fuse cabinet(s) in main electrical room(s).

C. Coordinate fuse sizes with installed equipment nameplate as to provide a fully selective system.

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 26 28 13

SECTION 26 41 13
LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes additional lightning protection for an existing building. The intent of this work is to provide safety for the new building additions and the occupants by eliminating damage to the structure caused by lightning, surges, and other related occurrences.

B. Related Sections include the following:

1. Section 260526 "Grounding and Bonding for Electrical Systems" for grounding work associated with this section.
2. Section 077200 “Roof Accessories” for adhesive and penetration work associated with this section.
3. Section 010000 “Alternates” for information relating to this section.

1.3 SUBMITTALS

A. Product Data: For all cabling, ground materials, air terminals, and mounting accessories.

B. Shop Drawings: Detail lightning protection system, including air-terminal locations and mounting details, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway and data on how concealment requirements will be met. Lighting protection construction document design is to be used as a basis for design. The shop drawing must incorporate any and all revisions required to meet UL certification.

C. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by nationally recognized testing laboratory (NRTL) or trade association.

D. Certification, signed by the Roofing (General) Contractor, that roof adhesive for air terminals is approved by manufacturers of both the terminal assembly and the single-ply membrane roofing material.

E. Field inspection reports indicating compliance with specified requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is certified by LPI as a Master Installer/Designer.

B. Listing and Labeling: As defined in NFPA 780, Article 2-2, "Definitions."

C. Provide UL Master Label “C”.

1.5 STANDARDS

A. UL 96A.

B. UL 96.

C. NFPA 780.

D. LPI 175.

1.6 COORDINATION

A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

B. Coordinate installation of air terminals attached to single-membrane roof systems with roofing manufacturer and installer, so as not to void any warranties (new or existing).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Capital Lightning Protection Co., Inc.
2. East Coast Lightning Equipment, Inc.
3. Harger Lightning Protection, Inc.
4. Heary Bros. Lightning Protection Co. Inc.
5. Independent Protection Company, Inc.
6. Robbins Lightning, Incorporated.
7. Thompson Lightning Protection, Inc.
8. Or approved equal as determined by the Engineer.

2.2 INSTALLERS

A. Installers: Contractor shall be an experienced installer of similar projects and be in good standing with the LPI. Subject to compliance with requirements, provide products by one of the following:

1. Quality Lightning Protection, Inc.
2. Or approved equal as determined by the Engineer.

2.3 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Comply with UL 96 and NFPA Class I. Provide copper/bronze construction for all cabling, terminals, and bonding equipment, unless otherwise required to be aluminum due to adjacent material construction.

B. Cables for Main Horizontal and Downlead Runs and Counterpoise: Smooth weave copper, No. 2, 32 strands, 17 AWG minimum. Aluminum, No. 1/0, 28 strands, 14 AWG minimum, only where required. Size all cables according to NFPA requirements.

C. Cables for Bonding of Aluminum Surfaces such as Air Handling Units and Exhaust Fans: Aluminum, 24 strands, 14 AWG minimum. Size all cables according to NFPA requirements.

D. Raceways: Provide 1″ Schedule 40 PVC conduit for all conductors noted in the Execution section.

E. Roof-Mounting and Stack-Mounting Air Terminals: Copper for most applications such as parapets and mid-roof penetrations, aluminum only for aluminum surfaces such as air handling units and exhaust fans.

1. Single-Membrane, Roof-Mounting Air Terminals: Designed for single-membrane roof materials.
2. Air Terminal Dimensions: ½″ diameter x 12″ tall, minimum.
3. Bases: Cast aluminum or bronze for various applicable surfaces and installations.

F. Miscellaneous Items: Provide the following cable connectors and roof accessories as required for a complete installation. Mate connector materials with corresponding cabling materials.

1. All bolts, nails, and screws to be stainless steel.
2. Cast aluminum or bronze splicers of various styles for different applications with stainless steel hardware for cable tension.
3. Through-roof assemblies including boot, cable connector, threaded rod, nuts and washers.
4. Strap aluminum or copper clad cable loop fastener with one nail/screw hole.
5. Drive-in anchors: One piece ¼″ x 1-1/4″ stainless steel.
6. Tek screw: Hex head stainless steel.
7. Stamped aluminum or copper adhesive cable holder.
8. Cast aluminum, bronze, or galvanized steel beam clamp.
9. 3M adhesive for tar and gravel roof.
10. Pourable sealer for rubber roofs.
11. Silicone rubber caulk and adhesive.
12. Sikaflex high strength adhesive and sealant.

G. Ground Rods, Plates, and Accessories:

1. Ground rods shall be ¾″ diameter x 10′ long copper clad.
2. Ground plates shall be 12″ x 12″ x ½″ copper bronze with tabs for ground wire connection.
3. Provide test wells where required in Part 3 and comply with Section 260526 "Grounding and Bonding for Electrical Systems" and standards referenced in this Section.
4. Cast aluminum or bronze grounding clamps for antennas or other metal pipes.
5. Cast aluminum or bronze flat metal bonding plate with stainless steel bolt for tension grip on cable. Minimum 8 square inch contact surface.
6. Cast aluminum or bronze bonding lug with stainless steel bolt for tension grip on cable.
7. Solid aluminum or bronze rod coupling and adapter for combining multiple lengths of ground rods.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780 in a neat, orderly, workmanlike, and inconspicuous manner by an LPI Master Installer.

B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops. All conductor bends to be a minimum of 90 degrees with a minimum 8 inch bending radius.

C. Conductors shall be fastened a minimum of 3 feet on center.

D. Conceal the following conductors in 1” Schedule 40 PVC conduit:

1. System conductors.
2. Down conductors.
3. Interior conductors.
4. Conductors within normal view from exterior locations at grade within 200 feet (60 m) of building.
5. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.

E. Cable Connections: Use approved bolted connections for all above grade conductor splices and connections. Use exothermic-welded connections for all conductor splices and connections for all below grade conductor splices and connections and for connections to steel beams and the main electrical service grounding electrode system.

F. Compatible Materials Installation Requirements: Per UL, metals shall be used in combination with those that are galvanically compatible. Therefore, aluminum components shall not be installed in direct contact with bare copper roofing materials/surfaces and copper components shall not be installed in direct contact with bare aluminum roofing materials/surfaces. Aluminum material shall be used on aluminum surfaces.

G. Coordinate new roof penetrations with Roofing Contractor to ensure the roofing warranty is not violated. Provide “Pate” type rubber boot and moisture sealant approved by the Roofing Contractor.

H. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions and coordinate in writing with Roofing (General) Contractor.

I. Provide tripod brace for supporting of extra long air terminals.

J. Bond extremities of all conductive bodies located on roof (whether or not shown on the electrical drawings) including, but not limited to: roof drains, roof access doors, stacks, vents, HVAC equipment, exhaust/relief/smoke purge fans, skylights, electric/telephone/radio/catv antennas, electrical/telecom overhead service entrance weatherheads, etc. per UL requirements.

K. Bond extremities of all vertical conductive bodies exceeding 60 feet (18 m) in length to lightning protection components.

L. Bond extremities of all conductive and inductive bodies located within 6 feet of main conductors.

M. A counterpoise installation, based on requirements in Section 260526 "Grounding and Bonding for Electrical Systems," shall be provided as a ground loop as indicated by NFPA 780. Counterpoise conductor size must meet or exceed minimum requirements in NFPA 780.

1. Bond ground terminals to counterpoise conductor.
2. Bond grounded metal bodies on building within 12 feet (3.6 m) of ground to counterpoise conductor.
3. Bond grounded metal bodies on building within 12 feet (3.6 m) of roof to counterpoise conductor.

N. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot (18-m) intervals.

O. Provide test wells for any and all ground rods concealed in paved or concrete areas according to direction given in Section 260526 “Grounding and Bonding for Electrical Systems.”

P. Bond lightning protection grounding electrode system to main electrical service grounding electrode system.

Q. If soil condition precludes the installation of ground rods, then ground plates can be used instead. The plates shall be buried a minimum of 24” deep BFG.

3.2 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.3 FIELD QUALITY CONTROL

A. Ground Rod/Plate Testing: Refer to Section 260526 “Grounding and Bonding for Electrical Systems” for testing requirements for each ground rod or plate.

B. UL Inspection: Apply for inspection by UL and modify system in the field as required to obtain a UL Master Label “C” for system. Once UL Master Label “C” is obtained, mount identification label on “MDP” service entrance panel(s). Lightning protection construction document drawings are shown for bidding/information purposes. Contractor/Installer is responsible for actual field conditions and performance requirements in order to achieve a UL Master Label “C.”

END OF SECTION 26 41 13

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps, and ballasts.
2. Exit signs.
3. Lighting fixture supports.

B. Related Sections include the following:

1. Section 010000 "Allowances" for fixtures that may be included as part of an allowance. Also refer to the lighting fixture schedule on the drawings.
2. Section 260924 "Lighting Control Devices" for automatic control of lighting, including localized and centralized lighting control systems.
3. Section 260529 "Hangers and Supports for Electrical Systems" for seismic supporting criteria.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions, material type for housing/ door frame/trim/lens/reflector/etc., mounting information, and efficacy and illuminance-efficiency data.
2. Emergency lighting units and battery packs including battery and charger information. Exit sign fixtures shall quantify the light uniformity across the face of the sign according to requirements in Part 2 below.
3. Ballast type, input voltage(s), sound transmission type, temperature operating limits, ballast factor, line current amperes, and power factor. Ballast cut sheet shall be separate from ballast manufacturer and not listed as an option or type on the fixture cut sheet.
4. Lamp type, life in hours, temperature in Kelvin, output in watts, Color Rendering Index, TLCP compliance, coated or clear, lamp pin/socket configuration, lamp orientation, and initial and mean lumen output for lamps. Lamp cut sheet shall be separate from lamp manufacturer and not listed as an option or type on the fixture cut sheet.
5. Point by point calculations to include the following:

    a. Point-by-point calculations of horizontal and vertical illuminance, at close grid size for viewing within the project area.
    b. Total electrical load, in kilowatts, of lighting system.
    c. LLF, LLD used in calculations.
    d. Summary table showing AVG, MAX, MIN, MAX/MIN, AVG/MIN, COEF VAR, UNIF GRAD.
    e. Location of fixtures with types.

6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
    b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

    1. Wiring Diagrams: Power and control wiring.

C. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:

    1. Lamps: Specified units installed.
    2. Accessories: Cords and plugs.

D. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

E. Qualification Data: For agencies providing photometric data for lighting fixtures.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. Emergency fixtures shall comply with UL 924, NEC Article 700, NFPA 5000, NFPA 1, NFPA 101, and Energy Star.

F. All fixtures shall be UL listed and have UL labeling on the fixtures according to the type of useage.

G. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections, where indicated in the construction documents by Architect or Engineer.

1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and required associated trims, plaster frames and suspension/mounting systems with the adjacent mounting surface that is supported by them.

B. Coordinate voltage of fixtures with floor plan circuiting, if not indicated on the light fixture schedule itself.

C. Coordinate the need for IC rated fixtures in IC rated ceilings with direct insulation contact.

D. Coordinate the need for tenting of fixtures or provision of fire rated enclosures (such as the product manufactured by E.Z. Barrier for recessed downlights) in fire rated ceilings.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: Ten years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
2. Warranty Period for Electromagnetic Ballasts: Two years from date of Substantial Completion.

C. Special Warranty for Linear Fluorescent and Compact Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below. Warranty shall be based on 8760 annual hours of operation.

1. Warranty Period: One year from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic and Parabolic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Battery and Charger Data: Furnish at least one for each emergency lighting unit of each type.

4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards (when they can be ordered as an individual piece): 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified either in these specifications or on the lighting fixture schedule on the drawings.
2. Substitutions: Substitutions will only be allowed to be submitted for pre-approval to the Engineer up to ten days prior to bid opening. The substitutions will be reviewed at that time by the Engineer. Substitution materials and equipment will only be incorporated into the project if the Engineer pre-approves the shop drawing(s) and lists the manufacturer’s make and model on an official written and distributed Addendum. No substitutions will be reviewed by the Engineer during construction.
3. Or approved equal as determined by the Engineer.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Manufacturers: Refer to the lighting fixture schedule on the drawings.

B. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

C. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

D. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

E. Pendant Mounted Fixtures in Finished Areas: Provide ¼ turn lamp sockets to eliminate lamps being ejected and clear acrylic or prismatic lens cover securely mounted to the top of the fixture to eliminate dust/debris collection on exposed lamps.

F. Metal Parts: Free of burrs and sharp corners and edges.

G. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

H. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

I. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

J. Open Exposed Lamps Over Food Prep Areas: Shall be shatterproof and labeled as such.

K. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

L. Ballast Disconnect Plugs: Provide factory wired disconnect plugs per fixture as required to meet the NEC.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Manufacturers:

1. Advance.
2. General Electric.
3. Magnetek/Universal.
4. Osram/Sylvania.
5. Or approved equal as determined by the Engineer.

B. Voltages: Provide dual voltage 120/277 volt for all linear fluorescent lamps.

C. Electronic Ballasts for T8 Lamps: Comply with ANSI C82.11; programmed rapid-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Class P, Sound A rating.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Transient Voltage Protection: IEEE C62.41, Category A or better.
4. Operating Frequency: 20 kHz or higher.
5. Lamp Current Crest Factor: 1.7 or less.
6. BF: 0.71, unless otherwise noted.

7. Power Factor: 0.98 or higher.
8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
9. Flicker: Maximum of 15%.
10. Ballast case temperature shall not exceed 25 degrees C rise over 40 degrees C ambient.
11. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

D. Electronic Programmed Rapid-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Class P, Sound Rating A.
4. Total Harmonic Distortion Rating: Less than 10 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. Flicker: Maximum of 15%.
11. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

E. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

F. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring with quick disconnects to suit final installation conditions without modification or rewiring in the field. For example, where a four foot fixture is shown to be continuously row mounted, fewer multi-lamp ballasts can be provided as long as the switching arrangement is maintained (all on or inboard/outboard).

G. Ballasts for Low-Temperature Environments:

1. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

H. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 10 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Manufacturers:

1. Advance.
2. General Electric.
3. Magnetek/Universal.
4. Osram/Sylvania.
5. Or approved equal as determined by the Engineer.

B. Voltages: Provide dual voltage 120/277 volt for all CFL lamps.

C. Triple Tube Lamps: Provide the “delta” shaped type for vertically oriented socket fixtures and the “D” shaped for horizontally oriented socket fixtures.

D. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Class P, Sound Rating A.
4. Total Harmonic Distortion Rating: Less than 10 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. Minimum BF: 0.85
9. Power Factor: 0.98 or higher.
10. Minimum Starting Temperature: 0 deg F (Minus 18 deg C).
11. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
12. Ballast Case Temperature: 75 deg C, maximum.
13. Wattages: Where multi-wattage (i.e. 26/32/42) and/or multi-lamp (i.e. 1/2) ballasts are available, provide ballasts of this type.

E. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 10 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 10 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.5 INCANDESCENT/HALOGEN LAMPS

A. Manufacturers:

1. General Electric.
2. Osram/Sylvania.
3. Philips.
4. Or approved equal as determined by the Engineer.

B. Types:

1. A 15-25.
2. BR 19-40.
3. Double-Ended Quartz.
4. G 16-40.
5. Mini Candle.
6. MR 11/16.
7. Par 16-64.
8. Single-Ended Quartz.

C. Description: Provide lamp wattage, pin/base type, beam pattern, voltage, transformer, etc. as indicated on the lighting fixture schedule and coordinated with fixture manufacturer.

D. Incandescent lamps installed in open reflector fixtures for food preparation/serving areas shall be of the shatterproof type either through the design of the lamp or with a protective overlay.

2.6 FLUORESCENT LAMPS

A. Manufacturers:

1. General Electric.
2. Osram/Sylvania.
3. Philips.
4. Or approved equal as determined by the Engineer.

B. Low-Mercury Lamps: Comply with EPA's Toxicity Characteristic Leaching Procedure (TCLP) test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1. Must have green tips for marking the end of the lamps.

C. T8 rapid-start, TCLP compliant lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 3100 initial lumens (minimum)unless otherwise noted, CRI 86 (minimum), color temperature (refer to the fixture schedule)K unless otherwise indicated, and average rated life 20,000 hours at 3 hours operation per start, unless otherwise indicated.

D. T5HO rapid-start, high-output, TCLP compliant lamps, rated 54 W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature (refer to the fixture schedule), and average rated life of 20,000 hours at 3 hours operation per start, unless otherwise indicated.

E. Compact Fluorescent Lamps: 4-Pin, TCLP compliant when available, CRI 82 (minimum), color temperature (refer to the fixture schedule), average rated life of 12,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.

1. 13 W: T4, short Twin Tube or Double Twin Tube, rated 800 initial lumens (minimum).
2. 18 W: T4, Double Twin Tube or Triple Twin Tube or long Twin Tube, rated 1200 lumens (minimum).
3. 26 W: T4, Double Twin Tube or Triple Twin Tube, rated 1800 lumens (minimum).

4. 32 W: T4, Triple Twin Tube, rated 2400 initial lumens (minimum).
5. 40 W: T4, long Twin Tube, rated 3300 initial lumens (minimum).
6. 42 W: T4, triple Twin Tube, rated 3200 initial lumens (minimum).
7. 50 W: T4, long Twin Tube, rated 4300 initial lumens (minimum).
8. 80 W: T4, long Twin Tube, rated 6000 initial lumens (minimum).

2.7 EXIT SIGNS

A. Manufacturers: Refer to the lighting fixture schedule on the drawings.

B. Description: Comply with UL 924 and NFPA 101 and NEMA; for sign colors, visibility, and luminance, comply with authorities having jurisdiction. Letters shall be 6″ high with a ¾″ brush stroke. Chevrons shall be viewable at 40 feet. Fixture shall maintain 30 candela/meter-squared for light uniformity across the face of the exit sign. Maximum wattage of either single or double face sign is to be 5 watts.

C. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life. Maximum LED failure rate shall be 25% within a seven (7) year period; otherwise, if exceeded, manufacturer shall replace the complete unit at no charge to the Owner.

2.8 EMERGENCY LIGHTING RELAY

A. Manufacturers:

1. 924, Inc.
2. Bodine.
3. Iota.
4. Or approved equal as determined by the Engineer.

B. Description: Self-contained power supply and low voltage relay units complying with UL 924, NEC Article 700, NFPA 101 and NEMA.

C. Allows normal switching of designated emergency lighting fixture(s) via dimmers, relays, or local switches while overriding this input and automatically switching the fixture(s) on when the normal power fails.

D. Wall mounted single gang unit with stainless steel device cover, test switch, and LED indicator lights. Amber LED indicator light for normal utility power availability. Red LED indicator light for unswitched emergency power availability. Green LED indicator light for notification that test switch is activated and emergency power is switched over.

E. Ten amp load rating.

F. Coordinate voltage rating with associated fixture circuiting.

G. Warranty: Full five year material warranty.

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with ceiling canopy. Finish same as fixture. Provide swivel hanger when mounted on sloped ceilings.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

H. Safety Chain: Provide safety chain, as suggested by manufacturer, from the fixture up to the structure as a secondary means of supporting all HID pendant mounted fixtures.

2.12 LED LIGHTING

A. Compliant fixtures per IESNA LM-79 and LM-80.

B. Minimum 70% lumen maintenance at 50,000 hours.

C. Minimum 5 year warranty on LED’s and driver.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four dedicated ceiling support system rods or wires for each 2’x2’, 1’x4’, 2’x4’, or 4’x4’ fixture, one at each corner of the fixture independently to the structure. Grid ceiling mounted troffers shall be installed so that they are flush with the ceiling grid after the grid has been leveled. Provide minimal slack in structure supports to allow for final leveling and adjustments of the ceiling. Locate not more than 6 inches (150 mm) from lighting fixture corners. Install a

minimum of one dedicated ceiling support system rod or wire for each downlight.

2. Hurricane Support Clips: Provide these as separate fasteners in addition to the factory installed clips on modern rectilinear troffer fixtures. Fasten to lay-in troffer lighting fixtures at or near each fixture corner. Provide clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. E.C. shall provide strut as required underneath elements such as ductwork to independently support their electrical equipment, such as light fixtures. No light fixture support wires shall touch an interfering object (such as ductwork) prior to terminating to the ceiling structure.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

F. Coordination: Coordinate lamp base, lamp orientation, and lamp pin/socket type between the lamp supplier and the fixture supplier.

G. In congested areas with exposed structure ceilings and pendant mounted lighting (i.e. mechanical rooms, elevator rooms, telecom rooms, electrical rooms, etc.), locate and suspend light fixtures as required in the field to avoid obstructions and to allow for the best possible light distribution. Span underneath ductwork and other obstructions as required with independent strut supported properly from the walls or the ceiling.

H. Emergency wall mounted fixtures shall be mounted at a minimum of 82″ AFF, unless otherwise noted.

I. Maintain manufacturer required clearances around fixtures (such as 3″ around recessed downlights) in ceilings with insulation.

J. Coordinate mounting height of all wall mounted fixtures (including wall sconces and fixtures in stairwells) with the Architect prior to rough-in.

K. Secure wiring harness to clips within exit signs so that this wiring is not exposed through the exit sign panel lettering.

L. Exit signs shall be no more than 100 feet from viewing area.

M. Grid ceiling mounted recessed downlights shall be centered in tile.

N. Remove all debris from lensed fixtures including instruction sheets, bugs, etc.

O. All ballast channel covers shall be installed as required.

P. All troffers shall have the door hinges secured.

3.2 CLEANING

A. Clean all exposed aluminum reflector surfaces with warm soapy water and a clean towel to eliminate fingerprints immediately after accidental touching of surfaces.

B. Remove all cardboard, manufacturer’s stickers, plastic covers, etc. from final installed light fixtures.

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to generator and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 51 00

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.

B. Related Sections include the following:

1. Section 265100 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings and lamp and ballast information.
2. Section 260529 "Hangers and Supports for Electrical Systems" for seismic supporting criteria.

1.3 DEFINITIONS

A. CRI: Color-rendering index.

B. HID: High-intensity discharge.

C. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

A. Product Data: For each luminaire and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions, material type for housing/ door frame/trim/lens/reflector/etc., effective projection area, mounting information, and efficacy and illuminance-efficiency data.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Emergency lighting units and battery packs including battery and charger information.
5. Ballast type, input voltage(s), sound transmission type, temperature operating limits, ballast factor, line current amperes, and power factor. Ballast cut sheet shall be separate from ballast manufacturer and not listed as an option or type on the fixture cut sheet.

6. Lamp type, life in hours, temperature in Kelvin, output in watts, Color Rendering Index, TLCP compliance, coated or clear, lamp pin/socket configuration, lamp orientation, and initial and mean lumen output for lamps. Lamp cut sheet shall be separate from lamp manufacturer and not listed as an option or type on the fixture cut sheet.
7. Materials, dimensions, and available finishes.
8. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
9. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

    a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    b. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings:

    1. Wiring Diagrams: Power and control wiring.

C. Samples for Verification: For products designated for sample submission in the lighting fixture schedule. Each sample shall include lamps and ballasts.

D. Qualification Data: For agencies providing photometric data for lighting fixtures.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For luminaires to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C2, "National Electrical Safety Code."

D. Comply with NFPA 70.

E. All fixtures shall be UL listed and have UL labeling on the fixtures according to the type of useage.

F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections, where indicated in the construction documents by Architect or Engineer.

1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Guards, Covers, and Other Optical Parts (when they can be ordered as an individual piece): 1 for every 20 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified either in these specifications or on the lighting fixture schedule on the drawings.
2. Substitutions: Substitutions will only be allowed to be submitted for pre-approval to the Engineer up to ten days prior to bid opening. The substitutions will be reviewed at that time by the Engineer. Substitution materials and equipment will only be incorporated into the project if the Engineer pre-approves the shop drawing(s) and lists the manufacturer’s make and model on an official written and distributed Addendum. No substitutions will be reviewed by the Engineer during construction.
3. Or approved equal as determined by the Engineer.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires. Refer to drawings for individual distribution patterns per fixture.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. House Side Shields: Metal baffles, factory installed and arranged to block light distribution to indicated portion of normally illuminated area or field. Refer to drawings for individual house side shields per fixture.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

   a. Color: As selected by Architect from manufacturer's standard catalog of colors.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

   a. Color: As selected by Architect from manufacturer's standard catalog of colors.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of

photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with NEMA C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.4 BALLASTS AND LAMPS

A. Refer to Section 265100 “Interior Lighting” for ballast and lamp information.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming per Engineer’s direction. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

D. Be aware of any potential light trespass issues and notify Architect prior to installation.

E. Coordination: Coordinate lamp base, lamp orientation, and lamp pin/socket type between the lamp supplier and the fixture supplier.

F. Fixtures/Housings Recessed in Concrete Wall or Floor: Acquire housing and/or backplate prior to floor or wall construction. Install raceway and backbox assembly in floor or wall at time of erection. Install wall mounted fixture according to coursing of block in the field.

3.2 BOLLARD LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Provide excavation and gravel backfill and concrete base. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling with non-shrink grout and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 26 "Common Work Results for Electrical." Coordinate with landscaping.

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Ground nonmetallic support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night as directed by Engineer. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):

a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting."
b. IESNA LM-72, "Directional Positioning of Photometric Data."

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaires. Refer to Section 260500 “Common Work Results for Electrical.”

END OF SECTION 26 56 00

SECTION 27 05 11
REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section, Requirements for Communications Installations, applies to all sections of Division 27.

B. Furnish and install communications cabling, systems, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of transformers, cable, and other items and arrangements for the specified items are shown on drawings.

1.2 MINIMUM REQUIREMENTS

A. References to industry and trade association standards and codes 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 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.

1.4 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 re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.5 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.6 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.

1.7 WORK PERFORMANCE

A. Job site safety and worker safety is the responsibility of the contractor.

B. For work on existing stations, arrange, phase and perform work to assure communications service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

C. 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 01 00 00, GENERAL REQUIREMENTS.

D. Coordinate location of equipment and pathways with other trades to minimize interferences. See the GENERAL CONDITIONS.

1.8 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. 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.

1.9 EQUIPMENT IDENTIFICATION

A. Install an identification sign which clearly indicates information required for use and maintenance of 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.

1.10 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage, or installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings, and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION.
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.

2. 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 01 00 00, GENERAL REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.

2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation and maintenance instructions.
   e. Safety precautions.
   f. Diagrams and illustrations.
   g. Testing methods.
   h. Performance data.
   i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
   j. 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 and pathway coupling, bushing and termination fitting.
   3. Raceway and pathway hangers, clamps and supports.
   4. Duct sealing compound.

1.11 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this

reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.12 TRAINING

A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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 31 20 11
EARTH MOVING (SHORT FORM)

PART 1 - GENERAL

1.1:DESCRIPTION:

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

1.2 DEFINITIONS:

A. Unsuitable Materials:
   1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
   2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.
   3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to COR's approval.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM D698.

D. The term fill means fill or backfill as appropriate.

1.3 RELATED WORK:

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

B. Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 CLASSIFICATION OF EXCAVATION:

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

B. Classified Excavation: Removal and disposal of all material not defined as rock.

C. Rock Excavation:

1. Solid ledge rock (igneous, metamorphic, and sedimentary rock).
2. Bedded or conglomerate deposits so cemented as to present characteristics of solid rock which cannot be excavated without blasting; or the use of a modern power excavator (shovel, backhoe, or similar power excavators) of no less than 0.75 m3 (1 cubic yard) capacity, properly used, having adequate power and in good running condition.
3. Boulders or other detached stones each having a volume of 0.4 m3 (1/2 cubic yard) or more.

1.5 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION:

A. Measurement: Cross section and measure the uncovered and separated materials, and compute quantities by the Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. Do not measure quantities beyond the following limits:

1. 300 mm (12 inches) outside of the perimeter of formed footings.
2. 600 mm (24 inches) outside the face of concrete work for which forms are required, except for footings.
3. 150 mm (6 inches) below the bottom of pipe and not more than the pipe diameter plus 600 mm (24 inches) in width for pipe trenches.
4. The outside dimensions of concrete work for which no forms are required (trenches, conduits, and similar items not requiring forms).

B. Payment for Differing Site Conditions: When rock excavation, as classified, is encountered, the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable.

1.6 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Rock Excavation Report:

1. Certification of rock quantities excavated.
2. Excavation method.

3. Labor.
4. Equipment.
5. Land Surveyor's or Civil Engineer's name and official registration stamp.
6. Plot plan showing elevations.

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 Nursery and Landscape Association (ANLA):
2004.....American Standard for Nursery Stock

C. American Association of State Highway and Transportation Officials (AASHTO):
T99-01 (R2004).....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop
T180-01 (2004).....Moisture-Density Relations of Soils Using a 4.54-kg [10 lb] Rammer and a 457 mm (18 inch) Drop

D. American Society for Testing and Materials (ASTM):
D698-07.....Laboratory Compaction Characteristics of Soil Using Standard Effort
D1557-02.....Laboratory Compaction Characteristics of Soil Using Modified Effort

E. Standard Specifications of (Insert name of local state) State Department of Transportation, latest revision.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m3 (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.

B. Granular Fill:
1. Under concrete slab, crushed stone or gravel graded from 25 mm (1 inch) to 4.75 mm (No. 4).
2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No. 4).

C. Fertilizer: (5-10-5) delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

D. Seed: Grass mixture comparable to existing turf delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

A. Clearing: Clearing within the limits of earthwork operations as described or designated by the COR. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash and any other obstructions. Remove materials from the Medical Center.

B. Grubbing: Remove stumps and roots 75 mm (3 inches) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inches) diameter, and nonperishable solid objects which will be a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.

C. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the COR. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials, larger than 0.014 m3 (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.

   1. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from the Medical Center.

D. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheeting and Bracing: Shore, brace, or slope to it's angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.
   1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.

B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from COR. When subgrade for foundations has been disturbed by water, remove the disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel.

C. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials, that are determined by the COR as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the COR, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on meters (yardage) in cut section only.

D. Finished elevation of subgrade shall be as follows:
   1. Pavement Areas - bottom of the pavement or base course as applicable.
   2. Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

3.3 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by COR.

B. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.

C. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without the prior approval of the COR. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer to not less than 95 percent of the maximum density determined in accordance with the following test method ASTM D698.

3.4 GRADING:

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

B. Cut rough or sloping rock to level beds for foundations. In unfinished areas fill low spots and level off with coarse sand or fine gravel.

C. Slope backfill outside the building away from the building walls for a minimum distance of 3048 mm (10 feet)at a minimum five percent (5%) slope.

D. The finished grade shall be 150 mm (6 inches) below bottom line of windows or other building wall openings unless greater depth is shown.

E. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.

F. Finish subgrade in a condition acceptable to the COR at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

G. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 LAWN AREAS:

A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations.

Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by COR before seeding or sodding operation begins.

B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

C. Fertilizing: Incorporate fertilizer into the soil to a depth of 100 mm (4 inches) at a rate of 12 kg/100 m2 (25 pounds per 1000 square feet).

D. Seeding: Seed at a rate of 2 kg/100 m2 (4 pounds per 1000 square feet) and accomplished only during periods when uniform distribution may be assured. Lightly rake seed into bed immediately after seeding. Roll seeded area immediately with a roller not to exceed 225 kg/m (150 pounds per foot) of roller width.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

B. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

3.7 CLEAN-UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Medical Center.

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SECTION 31 62 00.01
TIMBER PILES

1.1 INTRODUCTION
The following sample specification for timber piles is provided to illustrate the type of information that should be considered for inclusion in a specification. The traditional approach of a method and material specification is presented. The method approach requires that a site specific timber pile design be performed by the owner's engineer.

1.2 MATERIAL SPECIFICATION

PART 1—GENERAL
1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and
Supplementary Conditions and Division 1 Specification Sections, apply to this section.
Contractor to acquire the service of a Geotechnical Engineer to determine the length of piles to support structure. Shop drawing of piles shall be submitted for government approval.\

[Note: Drawings should indicate the plan layout and spacing of piles, pile design loads, size and length of piles, butt or tip circumference of piles, and cutoff elevation of piles, details of pile shoes, location and depth of pre-excavated holes for piles, location of test piles if in permanent locations.]

1.02 SUMMARY
A. This Section includes specifications for furnishing, installing, and testing of driven piles for structures. Piles shall be end-bearing piles, friction load-bearing piles or both as indicated.

B. Supply piles of the following types as indicated:
1. Timber piles, peeled and treated, driven.

C. Related Sections: For bracing, pile caps and framing, see Division 6, Rough Carpentry, or Heavy Timber Construction.

1.03 DEFINITIONS
A. Test Pile: An individual pile which is observed to determine its behavior during driving and under static axial compression load.

B. Reaction Pile: An individual pile which provides the reaction load required to perform the load test on a test pile. During this process the reaction pile can be subjected to either an axial compression load or an axial tension load.

1.04 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO). AASHTO M-133. Specification for Preservative and Pressure Treatment Process for Timber.

B. American Society for Testing and Materials (ASTM). ASTM D25 Specification for Round Timber Piles ASTM D1143 Method of Testing Piles Under Static Axial Compressive Load
ASTM D3689 Method of Testing Individual Piles Under Static Axial Tension Load

C. American Wood Preservers' Association (AWPA) AWPA C3. Piles - Preservative Treatment by Pressure Processes. AWPA C14. Wood for Highway Construction - Preservative Treatment by Pressure Processes. AWPA C18. Standard for Pressure treated Material in Marine Construction. AWPA M4. Standard for the Care of Preservative Treated Wood Products.

1.05 SUBMITTALS

A. General: Refer to Contract Requirements for Submittals, Shop Drawings, Product Data and Samples.

B. Shop Drawings: Submit shop drawings of pile types as follows:
1. Show any structural connections such as for uplift loads.

C. Pile Driving Sequential Layout:
1. Submit layout drawings showing the proposed sequence of driving the piles.
2. On the sequential layout, show each pile identification as indicated on the Contract Drawings, its driving sequence number, type, size, load bearing capacity and pile tip elevation planned.

D. Pile Driving Record: Maintain a pile driving record during pile driving and submit it to the Project Engineer upon completion of pile driving. On the record indicate, for each pile driven, the information specified in C above, and the following: type and rating of driving equipment, overall blow count per foot, number of blows per inch penetration for the last 12 inches, and any unusual conditions encountered during driving.

E. Equipment Review and Drawings:
1. Submit complete list of the equipment proposed for use, including a description of the characteristics of each piece of driving equipment.
a. The Project Engineer will review the proposed driving equipment, accessories, and methods of adequacy for the conditions expected to be encountered. However, the adequacy of the equipment and accessories shall remain the responsibility of the Contractor. Should the equipment used by the Contractor prove inadequate to drive the scheduled types of piles in the locations indicated, or should the use rate of accessories show damage to the piles, or should

the Progress Schedule not be maintained, the Contractor shall replace, or use different types of equipment.

2. Submit shop drawings of driving accessories showing compatibility with the size configuration, handling, and driving requirements of each type of pile indicated on the Contract Drawings.

3. Submit shop drawings showing the methods and equipment proposed for loading test piles.

F. Submit data on round timber pile treatment data, including certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handling, storage and field fabrication, including treating of cut ends, shall be in accordance with AWPA M4.

2.0 PART 2 – PRODUCTS

2.01 TIMBER PILES

A. Round Timber Piles: Piles shall be Southern Pine or Douglas Fir and shall conform to
ASTM D 25, unused, clean peeled, uniformly tapered, one piece from butt to tip.
[Note to Specifiers - Size: Specify butt or tip diameters from Tables 3-3 through 3-9.]
B. Pressure treatment shall be in accordance with the following Use Category
Standards:

Foundation piles. AWPA C3.
Land and fresh water piles. AWPA C3.
Marine piles. AWPA C3 and C18.
Highway bridge piles. AWPA C14.
Marine, dual treatment. AWPA C3.
Field treatment of cut ends and holes. AWPA M4.

C. Preservatives and Retentions:
Creosote (pcf) Waterborne (CCA or ACZA) (pcf)
Use Category Southern Pine Douglas Fir Southern Pine Douglas Fir
CCA ACZA
Foundation 12 17 0.8 1.0
Land & Fresh Water 12 17 0.8 1.0
Marine

D. Fabrication
1. Field-Applied Wood Preservative: Treat field cuts, holes, and other penetrations in accordance with AWPA M4.

PART 3 - EXECUTION

3.01 PILE TYPES
Piles shall be end-bearing type or friction type as indicated. Drive end-bearing piles to the required bearing value. The bearing value for each pile shall be as determined in Article 3.04. Drive friction piles to the required penetration, as required.

3.02 DETERMINATION OF LENGTH
A. Provide piles of such length as required to develop the specified bearing value, to obtain the specified penetration, and to extend into the cap or footing block as required

B. Assume responsibility for furnishing piles of sufficient length to obtain the penetration and bearing value.

3.03 TEST PILES
A. The Contract Drawings indicate the required type of piling, the required bearing value, the minimum penetration, and the estimated pile tip elevation. Estimated tip elevations are approximate, based upon subsurface explorations, and are given only to show the basis for the estimated quantities indicated in the Bid Schedule and to indicate the required lengths of test piles.

B. Order and drive the test piles. Safe bearing capacities of the test piles will be determined by methods herein specified.

C. From the test pile data and behavior and the subsurface exploration data, the Design Engineer will determine the penetration required. A Register (Design) engineer will determine the required penetration based upon settlement criteria or any other factors which in the opinion of the Design Engineer are applicable to the work. Submit the final data to the COR for evaluation and approval.

3.04 DRIVEN PILE CAPACITY
A. Design
1. The ultimate pile capacity will be determined by the Design Engineer. Drive piles with approved driving equipment to the ordered length or other lengths necessary to obtain the required ultimate pile capacity. Jetting, pre-drilling or other methods to facilitate pile penetration shall not be used unless specifically permitted by the Design Engineer.

2. Penetration per blow may be measured either during initial driving or during re-driving following a set period of time as determined by the Design Engineer.

B. Practical Refusal: Practical refusal will be determined by the Design Engineer, and will be a condition where the blow count exceeds either two times the number of blows required in 1 foot or three times the number of blows required in 3 inches to achieve the required bearing value, not to exceed 5 blows per inch. Piles reaching practical refusal shall not be driven further.

3.05 PILE LOAD TESTS FOR PILES UNDER AXIAL COMPRESSION LOAD

A. Install test piles and reaction piles, of the same type and kind as permanent piles, in the locations indicated by the Design Engineer. Install test piles vertically.

B. Test piles which pass the load test in an undamaged condition, may be utilized as permanent piles in the work. Reaction piles which were used to perform the pile load test may be utilized as permanent piles in the work, provided they are not damaged and that they are not moved upward.

C. Either extract damaged test piles and reaction piles and remove from the site, or cut them off 3 feet below any structure to be installed above.

D. Comply with ASTM D1143 for pile load test apparatus, for applying load and measuring movements, and for standard measuring procedures. Perform loading procedures as follows:

1. Apply the load in load increments of 10-15% of the design load to a maximum load of 300% or failure, whichever occurs first. Maintain each test load for 2.5 minutes.

2. Measure the settlement and rebound of the test pile to the nearest 0.01 inch.

E. Do not subject reaction piles which are to become permanent piles to uplift loads greater than 70 percent of the required bearing capacity. Test reaction piles in accordance with ASTM D3689.

F. Safe bearing capacity of the test pile shall be defined as 50% of the failure load. The failure load shall be defined as the load that produces a movement of the pile butt

(S_f) equal to:

$S_f = S + (0.15 + 0.008D)$

Where:

S_f = Settlement at failure in inches

D = Pile diameter or width in inches

S = Elastic deformation of total unsupported pile length in inches

G. The Design Engineer may require additional load tests in the event that the behavior of the test pile or any other pile shows any peculiarity, erratic action, or otherwise causes suspicion as to the reliability of the safe bearing capacity.

H. Immediately following completion of load testing, submit two copies of the test report for each test pile to the Project Manager. Include in the test report the data required by ASTM D1143.

I. Following the completion of load tests, the Design Engineer will make a determination of the required penetration.

3.06 INSTALLATION OF PILES

A. General: Provide piles of the type indicated and of the length and configuration necessary to:

1. Achieve the required penetration determined by the Design Engineer;
2. Extend into the pile cap or structure footing to the location directed by the Design Engineer; and
3. Attain indicated bearing capacity.

B. Penetration and Bearing: Install piles to the required penetration, or to the required bearing, as indicated, except as specified in Article 3.04, C and D. Jetting will not be permitted unless specifically approved by the Design Engineer for the location.

C. Predrilled Holes:

1. When necessary to achieve the required penetration, drill holes of diameter not greater than 90 percent of the average cross-sectional dimension of the pile at the depth being drilled, and drive the pile therein to practical refusal.

D. Pile Driving:

1. Complete backfill to the required elevations in the area which piles are to occupy before starting to drive piles.
2. Do not drive piles within 20 feet of concrete less than seven days old.
3. Drive piles at interior of bases of footings before driving perimeter piles.
4. If necessary, provide adequate lateral support for installed individual piles to prevent excessive temporary flexural stresses or movement of the pile top out of tolerance.
5. Maintain the hammer coaxial with the pile during the driving operation by using a combination of driving cap and leads.
6. Investigate any sudden decrease in driving resistance for possible breakage of the pile. If sudden decrease in driving resistance cannot be correlated to boring data or some incident in the driving, and if the pile cannot be inspected, such decrease in driving resistance may be cause for rejection of the pile.
7. Re-drive any pile which is raised during driving of adjacent piles, to the original tip elevation.
8. Cut off piles at top elevation directed by the Design Engineer. Replace or repair piles which are damaged when cut off.

E. Installation Tolerances:

1. Deviation from plumb and angle of batter: ¼ inch per foot of pile length, but not more than 6 inches overall.2. Deviation from location of pile top: 6 inches.

F. Piles not meeting ASTM D25 requirements will be rejected. Remove such piles from the site and replace with sound piles. Piles broken under driving stresses may be cut off and left in place if approved by the Design Engineer for the location. Otherwise they shall be extracted and removed from the site.

G. Fit timber piles with metal shoes on the tip as shown on the Contract Drawings
(when specified). When the area of the head of a timber pile is greater than that of the face of the hammer, use a suitable cap to distribute the blows throughout the cross section of the pile.
After timber piles are cut off, treat cut surfaces in accordance with AWPA M4.
Remove cutoff sections of piles from the site and legally dispose.

3.0**7 DISPOSAL**

Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner’s property.

- - - E N D - - -

SECTION 32 05 23
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:

B. Curb, gutter, and combination curb and gutter.

C. Pedestrian Pavement: Walks, grade slabs, lawn mower strips, crossings, and wheelchair curb ramps.

1.2 RELATED WORK

A. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Subgrade Preparation: Section 31 20 11, EARTH MOVING (SHORT FORM).

1.3 DESIGN REQUIREMENTS

Design all elements with the latest published version of applicable codes.

1.4 WEATHER LIMITATIONS

A. HOT WEATHER:

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by COR.

B. COLD WEATHER:

Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyantes or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by COR.

1.5 SUBMITTALS

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

B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.

1. Expansion joint filler
2. Hot poured sealing compound

3. Reinforcement
4. Curing materials

C. Data and Test Reports: Select subbase material.
1. Job-mix formula.
2. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.

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. Refer to the latest edition of all referenced Standards and codes.

B. American Association of State Highway and Transportation Officials (AASHTO):

M31.....Deformed and Plain Billet Steel Bars for Concrete Reinforcement (ASTM A615/A615M-96A)

M55M/55M.....Welded Steel Wire Fabric for Concrete Reinforcement (ASTM A185)

M147.....Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses (R 1996)

M148.....Liquid Membrane-Forming Compounds for Curing Concrete (ASTM C309A)

M171.....Sheet Materials for Curing Concrete (ASTM C171

M182.....Burlap Cloth Made from Jute or Kenaf

M213.....Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type) (ASTM D1751)

T99.....Moisture-Density Relations of Soils Using a 2.5 kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop

T180.....Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

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

C94/C94M.....Ready-Mixed Concrete

C143/C143M.....Slump of Hydraulic Cement Concrete

SPEC WRITER NOTE: Update materials to agree with requirements (type, grades, class, test method, tables, etc.) specified in the referenced APPLICABLE PUBLICATIONS.

PART 2 - PRODUCTS

2.1 GENERAL

A. Concrete shall be Type C, air-entrained, with the following exceptions:

TYPE	MAXIMUM SLUMP*
Curb & Gutter	75 mm (3")
Pedestrian Pavement	75 mm (3")
Vehicular Pavement	50 mm (2") (Machine Finished) 100 mm (4") (Hand Finished)
Equipment Pad	75 to 100 mm (3" to 4")
* For concrete to be vibrated: Slump as determined by ASTM C143. Tolerances as established by ASTM C94.	

B. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

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

Nominal Maximum Size of Total Air Content	Coarse Aggregate, mm (Inches) Percentage by Volume
10 mm (3/8 in).6 to 10	13 mm (1/2 in).5 to 9
20 mm (3/4 in).4 to 8	25 mm (1 in).3-1/2 to 6-1/2
40 mm (1 1/2 in).3 to 6	

TABLE IV
AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE

Nominal Maximum size of Total Air Content	Coarse Aggregate, mm’s (Inches) Percentage by Volume
Greater than 10 mm (3/8 in) 4 to 8	10 mm (3/8 in) or less 5 to 9

2.2 REINFORCEMENT

A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.

B. Welded wire-fabric shall conform to AASHTO M55.

C. Dowels shall be plain steel bars conforming to AASHTO M31 or M42. Tie bars shall be deformed steel bars conforming to AASHTO M31 or M42.

D. Reinforcement is to be free of all debris such as previous casting, dirt, or any foreign material before casting operations can begin.

2.2.2 Spacers.

A. Are to be submitted for government approval.

2.3 SELECT SUBBASE

A. Subbase material shall consist of select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials conforming to AASHTO M147, Grading E or F.

B. Materials meeting other gradations than that noted will be acceptable whenever the gradations are within a tolerance of three to five percent, plus or minus, of the single gradation established by the job-mix formula.

C. Subbase material shall produce a compacted, dense-graded course, meeting the density requirement specified herein.

2.4 FORMS

A. Use metal or wood forms that are straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved.

B. Do not use forms if they vary from a straight line more than 3 mm (1/8 inch) in any 3000 mm (ten foot) long section, in either a horizontal or vertical direction.

C. Wood forms should be at least 50 mm (2 inches) thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii.

d. Forms are to be greased prior to casting operations.

2.5 CONCRETE CURING MATERIALS

A. Concrete curing materials shall conform to one of the following:

1. Burlap conforming to AASHTO M182 having a weight of 233 grams (seven ounces) or more per square meter (yard) when dry.
2. Impervious Sheeting conforming to AASHTO M171.
3. Liquid Membrane Curing Compound conforming to AASHTO M148 (ASTM C309), Type 2, and shall be free of paraffin or petroleum.

2.6 EXPANSION JOINT FILLERS

Material shall conform to AASHTO M213.

PART 3 - EXECUTION

3.1 SUBGRADE PENETRATION

A. Prepare, construct, and finish the subgrade as specified in Section 31 20 11, EARTH MOVING (SHORT FORM).

B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE

A. Mixing: Proportion the select subbase by weight or by volume in quantities so that the final approved job-mixed formula gradation, liquid limit, and plasticity index requirements will be met after subbase course has been placed and compacted. Add water in approved quantities, measured by weight or volume, in such a manner to produce a uniform blend.

B. Placing:

1. Place the mixed material on the prepared subgrade in a uniform layer to the required contour and grades, and to a loose depth not to exceed 200 mm (8 inches), and that when compacted, will produce a layer of the designated thickness.
2. When the designated compacted thickness exceeds 150 mm (6 inches), place the material in layers of equal thickness. Remove unsatisfactory areas and replace with satisfactory mixture, or mix the material in the area.
3. In no case will the addition of thin layers of material be added to the top layer in order to meet grade.
4. If the elevation of the top layer is 13 mm (1/2 inch) or more below the grade, excavate the top layer and replace with new material to a depth of at least 75 mm (3 inches) in compacted thickness.

C. Compaction:

1. Perform compaction with approved equipment (hand or mechanical) well suited to the material being compacted.
2. Moisten or aerate the material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.
3. Compact each layer to at least 95 percent or 100 percent of maximum density as determined by AASHTO T180 or AASHTO T99 respectively.

D. Smoothness Test and Thickness Control:

Test the completed subbase for grade and cross section with a straight edge.

1. The surface of each layer shall not show any deviations in excess of 10 mm (3/8 inch).
2. The completed thickness shall be within 13 mm (1/2 inch) of the thickness as shown.

E. Protection:

1. Maintain the finished subbase in a smooth and compacted condition until the concrete has been placed.
2. When Contractor's subsequent operations or adverse weather disturbs the approved compacted subbase, excavate, and reconstruct it with new

material meeting the requirements herein specified, at no additional cost to the VA.

3.3 SETTING FORMS

A. Base Support:

1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.

B. Form Setting:

1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.
3. Forms shall conform to line and grade with an allowable tolerance of 3 mm (1/8 inch) when checked with a straightedge and shall not deviate from true line by more than 6 mm (1/4 inch) at any point.
4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
5. Clean and oil forms each time they are used.

C. The Contractor’s Registered Professional Land Surveyor, specified in Section 00 72 00, GENERAL CONDITIONS, shall establish and control the alignment and the grade elevations of the forms or concrete slipforming machine operations.

1. Make necessary corrections to forms immediately before placing concrete.
2. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete.

3.4 EQUIPMENT

A. The COR shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.

B. Maintain equipment and tools in satisfactory working condition at all times.

3.5 PLACING REINFORCEMENT

A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.

B. Before the concrete is placed, the COR shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

3.6 PLACING CONCRETE - GENERAL

A. Obtain approval of the COR before placing concrete.

B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the COR before placing concrete.

C. Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.

D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.

E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.

F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.

G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

3.7 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.

B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.

C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.

D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.

E. Finish the surface to grade with a wood or metal float.

F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

3.8 PLACING CONCRETE FOR VEHICULAR PAVEMENT

A. Deposit concrete into the forms as close as possible to its final position.

B. Place concrete rapidly and continuously between construction joints.

C. Strike off concrete and thoroughly consolidate by a finishing machine, vibrating screed, or by hand-finishing.
D. Finish the surface to the elevation and crown as shown.
E. Deposit concrete as near the joints as possible without disturbing them but do not dump onto a joint assembly. Do not place adjacent lanes without approval by the COR.

3.9 CONCRETE FINISHING - GENERAL

A. The sequence of operations, unless otherwise indicated, shall be as follows:
   1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
   2. Maintain finishing equipment and tools in a clean and approved condition.

3.10 CONCRETE FINISHING CURB AND GUTTER

A. Round the edges of the gutter and top of the curb with an edging tool to a radius of 6mm (1/4 inch) or as otherwise detailed.
B. Float the surfaces and finish with a smooth wood or metal float until true to grade and section and uniform in textures.
C. Finish the surfaces, while still wet, with a bristle type brush with longitudinal strokes.
D. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the surface, while still wet, in the same manner as the gutter and curb top.
E. Except at grade changes or curves, finished surfaces shall not vary more than 3 mm (1/8 inch) for gutter and 6 mm (1/4 inch) for top and face of curb, when tested with a 3000 mm (10 foot) straightedge.
F. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.
G. Correct any depressions which will not drain.
H. Visible surfaces and edges of finished curb, gutter, and combination curb and gutter shall be free of blemishes, form marks, and tool marks, and shall be uniform in color, shape, and appearance.

3.11 CONCRETE FINISHING PEDESTRIAN PAVEMENT

A. Walks, Grade Slabs, Lawn Mower Crossings, and Wheelchair Curb Ramps:
   1. Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.
   2. Brooming shall be transverse to the line of traffic.
   3. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.

4. Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 2 mm (1/16 inch) in depth.
5. The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 5 mm (3/16 inch) when tested with a 3000 mm (10 foot) straightedge.
6. The thickness of the pavement shall not vary more than 6 mm (1/4 inch).
7. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

3.12 CONCRETE FINISHING FOR VEHICULAR PAVEMENT

A. Accomplish longitudinal floating with a longitudinal float not less than 3000 mm (10 feet) long and 150 mm (6 inches) wide, properly stiffened to prevent flexing and warping. Operate the float from foot bridges in a sawing motion parallel to the direction in which the pavement is being laid from one side of the pavement to the other, and advancing not more than half the length of the float.
B. After the longitudinal floating is completed, but while the concrete is still plastic, eliminate minor irregularities in the pavement surfaces by means of metal floats, 1500 mm (5 feet) in length, and straightedges, 3000 mm (10 feet) in length. Make the final finish with the straightedges, which shall be used to float the entire pavement surface.
C. Test the surface for trueness with a 3000 mm (10 foot) straightedge held in successive positions parallel and at right angles to the direction in which the pavement is being laid and the entire area covered as necessary to detect variations. Advance the straightedge along the pavement in successive stages of not more than one half the length of the straightedge. Correct all irregularities and refinish the surface.
D. The finished surface of the pavement shall not vary more than 6 mm (1/4 inch) in both longitudinal and transverse directions when tested with a 3000 mm (10 foot) straightedge.
E. The thickness of the pavement shall not vary more than 6 mm (1/4 inch).
F. When most of the water glaze or sheen has disappeared and before the concrete becomes nonplastic, give the surface of the pavement a broomed finish with an approved fiber broom not less than 450 mm (18 inches) wide. Pull the broom gently over the surface of the pavement from edge to edge. Brooming shall be transverse to the line of traffic and so executed that the corrugations thus produced will be uniform in

character and width, and not more than 3 mm (1/8 inch) in depth. Carefully finish the edge of the pavement along forms and at the joints with an edging tool. The brooming shall eliminate the flat surface left by the surface face of the edger.

G. The finish surfaces of new and existing abutting pavements shall coincide at their juncture.

3.13 JOINTS - GENERAL

A. Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.

B. Joints shall be straight and continuous from edge to edge of the pavement.

3.14 CONTRACTION JOINTS

A. Cut joints to depth as shown with a grooving tool or jointer of a radius as shown or by sawing with a blade producing the required width and depth.

B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to the cross sections of the curb and gutter.

C. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.

D. Finish edges of all joints with an edging tool having the radius as shown.

E. Score pedestrian pavement with a standard grooving tool or jointer.

3.15 EXPANSION JOINTS

A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.

B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.

C. Anchor with approved devices to prevent displacing during placing and finishing operations.

D. Round the edges of joints with an edging tool.

E. Form expansion joints as follows:

1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.
2. Using joint filler of the type, thickness, and width as shown.
3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

3.16 CONSTRUCTION JOINTS

A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown.

B. Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.

C. Use a butt-type joint with dowels in curb and gutter if the joint occurs at the location of a planned joint.

D. Use keyed joints with tiebars if the joint occurs in the middle third of the normal curb and gutter joint interval.

3.17 FORM REMOVAL

A. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.

B. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

3.18 CURING OF CONCRETE

A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the COR.

B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 150 mm (6 inches).

C. Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at lease 0.1 mm (4 mils) in thickness. Wet the entire exposed concrete surface with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 300 mm (12 inches). Securely anchor sheeting.

D. Liquid Membrane Curing:

1. Apply pigmented membrane-forming curing compound in two coats at right angles to each other at a rate of 5 m^2/L (200 square feet per gallon) for both coats.
2. Do not allow the concrete to dry before the application of the membrane.
3. Cure joints designated to be sealed by inserting moistened paper or fiber rope or covering with waterproof paper prior to application of

the curing compound, in a manner to prevent the curing compound entering the joint.

4. Immediately re-spray any area covered with curing compound and damaged during the curing period.

3.19 CLEANING

A. After completion of the curing period:

1. Remove the curing material (other than liquid membrane).
2. Sweep the concrete clean.
3. After removal of all foreign matter from the joints, seal joints as herein specified.
4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

3.20 PROTECTION

The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the COR, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the COR.

3.21 FINAL CLEAN-UP

Remove all debris, rubbish and excess material from the Station.

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SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 – GENERAL

1.1 DESCRIPTION

This work consists of all labor, materials, and equipment necessary for furnishing and installing chain link fence, gates and accessories in conformance with the lines, grades, and details as shown.

1.2 RELATED WORK

A. Card readers and biometric devices: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS

B. Security fences: Section 32 31 53, PERIMETER SECURITY FENCES AND GATES.

1.3 MANUFACTURER'S QUALIFICATIONS

Fence, gates, and accessories shall be products of manufacturers' regularly engaged in manufacturing items of type specified.

1.4 SUBMITTALS

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

1. Manufacturer's Literature and Data: Chain link fencing, gates and all accessories.
2. Manufacturer's Certificates: Zinc-coating complies with complies with specifications.

B. Shop Drawings for sliding gates.

C. Certification that fence alignment meets requirements of contract documents.

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.

SPEC WRITER NOTE: Delete publications which do not apply to the project.

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

A121-07.....Metallic Coated Carbon Steel Barbed Wire
A392-07.....Zinc-Coated Steel Chain-Link Fence Fabric
A817-07.....Metal-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire
C94/C94M–07.....Ready-Mixed Concrete
F567-07.....Installation of Chain-Link Fence
F626-(R2003).....Fence Fittings

F900-05.....Industrial and Commercial Swing Gates
F1043-06.....Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
F1083-08.....Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

C. Federal Specifications (Fed. Spec.):
FF-P-110J.....Padlock, Changeable Combination

PART 2 - PRODUCTS

2.1 GENERAL

Materials shall conform to ASTM F1083 and ASTM A392 ferrous metals, zinc-coated; and detailed specifications forming the various parts thereto; and other requirements specified herein. Zinc-coat metal members (including fabric, gates, posts, rails, hardware and other ferrous metal items) after fabrication shall be reasonably free of excessive roughness, blisters and sal-ammoniac spots.

2.2 CHAIN-LINK FABRIC

ASTM A392 9 gauge wire woven in a 50 mm (2 inch) mesh. Top and bottom selvage shall have twisted and barbed finish. Zinc-coating weight shall be 570 grams/m^2 (2.0 ounces per square foot).

2.3 POST, FOR GATES AND FENCING

ASTM F1083, Grade SK-40A, round, zinc-coated steel. Dimensions and weights of posts shall conform to the tables in the ASTM Specification. Provide post braces and truss rods for each gate, corner, pull or end post. Provide truss rods with turnbuckles or other equivalent provisions for adjustment.

2.4 TOP RAIL AND BOTTOM RAIL

ASTM F1083, Grade SK-40A, round, zinc-coated steel. Dimensions and weights of posts shall conform to the tables in the ASTM Specification; fitted with suitable expansion sleeves and means for securing rail to each gate, corner, and end posts.

2.5 TOP AND BOTTOM TENSION WIRE

ASTM A817 and ASTM F626, zinc-coated, having minimum coating the same as the fence fabric.

2.6 ACCESSORIES

Accessories as necessary caps, rail and brace ends, wire ties or clips, braces and tension bands, tension bars, truss rods, and miscellaneous accessories conforming to ASTM F626.

2.7 GATES

ASTM F900, type as shown. Gate framing, bracing, latches, and other hardware zinc-coating weight shall be the same as the FABRIC. Gate leaves more than 2400 mm (8 feet) wide shall have either intermediate members and diagonal truss rods, or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gates less than 2400 mm (8 feet) wide shall have truss rods or intermediate braces. Attach gate fabric to the gate frame by method standard with the manufacturer, except that welding will not be permitted. Arrange latches for padlocking so that padlock will be accessible from both sides of the gate regardless of the latching arrangement. When required, extend each end member of gate frame sufficiently above the top member or provide three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

2.8 GATE HARDWARE

A. Manufacturer's standard products, installed complete. The type of hinges shall allow gates to swing through 180 degrees, from closed to open position. Hang and secure gates in such a manner that, when locked, they cannot be lifted off hinges.

B. Provide stops and keepers for all double gates. Latches shall have a plunger-bar arranged to engage the center stop. Arrange latches for locking. Center stops shall consist of a device arranged to be set in concrete and to engage a plunger bar. Keepers shall consist of a mechanical device for securing the free end of the gate when in full open position.

C. Equip gate openings with padlock conforming to Fed Spec FF-P-110H, Type EPC, size 50 mm (2 inch). Padlocks shall have chains that are securely attached to the gate or gate post. Before padlocks are delivered to project, submit sample to COR for approval. Approved sample may be incorporated in work. Key padlock as directed by the COR.

2.9 CONCRETE

ASTM C94/C94M, using 19 mm (3/4 inch) maximum-size aggregate, and having minimum compressive strength of 25 mPa (3000 psig) at 28 days. Non-shrinking grout shall consist of one part Portland cement to three parts clean, well-graded sand, non-shrinking grout additive and the minimum amount of water to produce a workable mix.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fence by properly trained crew, on previously prepared surfaces, to line and grade as shown. Install fence in accordance with ASTM F567 and with the manufacturer's printed installation instructions, except as modified herein or as shown. Maintain all equipment, tools, and machinery while on the project in sufficient quantities and capacities for proper installation of posts, chain links and accessories.

3.2 EXCAVATION

Excavation for concrete-embedded items shall be of the dimensions shown, except in bedrock. If bedrock is encountered before reaching the required depth, continue the excavation to the depth shown or 450 mm (18 inches) into the bedrock, whichever is less, and provide a minimum of 50 mm (2 inches) larger diameter than the outside diameter of the post. Clear loose material from post holes. Grade area around finished concrete footings as shown and dispose of excess earth as directed by the COR.

3.3 POST SETTING

Install posts plumb and in alignment. Set post in concrete footings of dimensions as shown, except in bedrock. Thoroughly compact concrete so as it to be free of voids and finished in a slope or dome to divert water running down the post away from the footing. Install posts in bedrock with a minimum of 25 mm (one inch) of non-shrinking grout around each post. Thoroughly work non-shrinking grout into the hole so as to be free of voids and finished in a slope or dome. Cure concrete and grout a minimum of 72 hours before any further work is done on the posts.

3.4 POST CAPS

Fit all exposed ends of post with caps. Provide caps that fit snugly and are weathertight. Where top rail is used, provide caps to accommodate the top rail. Install post caps as recommended by the manufacturer and as shown.

3.5 TOP RAILS AND BOTTOM RAILS

Install rails before installing chain link fabric. Provide suitable means for securing rail ends to terminal and intermediate post. The rails shall have expansion couplings (rail sleeves) spaced as

recommended by the manufacturer. Where fence is located on top of a wall, install expansion couplings over expansion joints in wall.

3.6 TOP AND BOTTOM TENSION WIRE

Install and pull taut tension wire before installing the chain-link fabric.

3.7 ACCESSORIES

Supply accessories (posts braces, tension bands, tension bars, truss rods, and miscellaneous accessories), as required and recommended by the manufacturer, to accommodate the installation of a complete fence, with fabric that is taut and attached properly to posts, rails, and tension wire.

3.8 FABRIC

Pull fabric taut and secured with wire ties or clips to the top rail and tension wire close to both sides of each post and at intervals of not more than 600 mm (24 inches) on centers. Secure fabric to posts using stretcher bars and ties or clips.

3.9 GATES

Install gates plumb, level, and secure for full opening without interference. Set keepers, stops and other accessories into concrete as required by the manufacturer and as shown. Adjust hardware for smooth operation and lubricate where necessary.

3.10 REPAIR OF GALVANIZED SURFACES

Use galvanized repair compound, stick form, or other method, where galvanized surfaces need field or shop repair. Repair surfaces in accordance with the manufacturer's printed directions.

3.11 FINAL CLEAN-UP

Remove all debris, rubbish and excess material from the station.

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