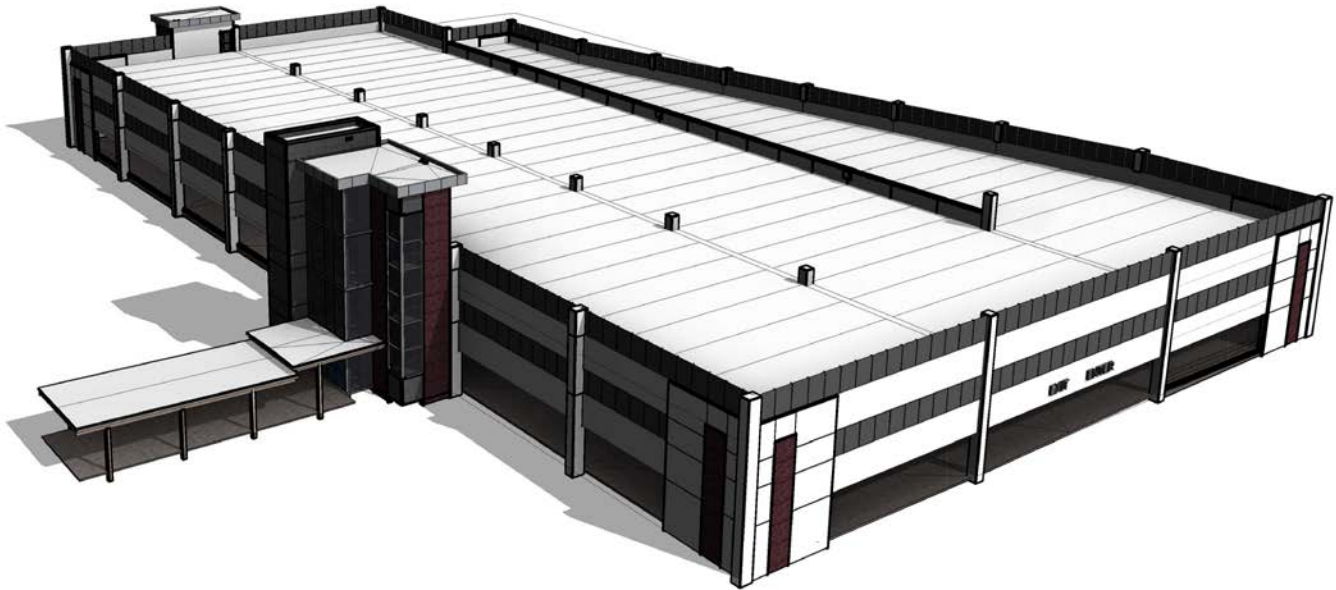


CONSTRUCT NEW PARKING GARAGE

Project # 659-342

For the
Department of Veterans Affairs
W.G. (Bill) Hefner Veterans Medical Center
Salisbury, NC 28144

PROJECT MANUAL Vol. 1 DIVISIONS 00 – 14



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SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for NEW PARKING GARAGE as required by drawings and specifications.
- B. It shall be the Contractor's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed. Only one (1) site visit will be conducted on the date of the pre-proposal conference. The date, time and location of the pre-proposal conference is as stated in the solicitation. Attendance is recommended, but not required. Submission of bid will acknowledge the contractor's review and coordination of existing building conditions and construction.
- C. Offices of GUIDON DESIGN INC, 905 N CAPITAL ST. INDIANAPOLIS IN. 46204 www.GuidonDesign.com as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative. Contracting officer's representative is designated in specifications as COR and/or Resident Engineer.
- D. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- E. Prior to commencing work, general contractor shall provide proof that a OSHA designated "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- F. Training:
 - 1. All employees of general contractor or subcontractors shall have the 10-hour or 30-hour OSHA Construction Safety course and other relevant

Salisbury VAMC
Construct New Parking Garage
Salisbury, NC 28144

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competency training, as determined by RE/COR acting as the
Construction Safety Officer with input from the facility Construction
Safety Committee.

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

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

1.2 STATEMENT OF BID ITEM(S)

- A. ITEM I, GENERAL CONSTRUCTION BASE BID: Work includes demolition, general construction and alterations of existing parking lot, roadway, concrete sidewalks, necessary structure, curbs, gutters and site utilities; construction of a three level parking structure with stair towers and elevators, foundation, masonry works, HVAC, plumbing, electrical, utility systems, site utilities, parking lot, roadway, landscaping and earthwork applications and other items as indicated and/or specified.
- B. ITEM II, ALTERNATE NO. 1: Perform all work described in Item I BASE BID above except DELETE planting by 50%: Reduce landscaping plantings as indicted on drawings.
- C. ITEM III, ALTERNATE NO. 2: Perform all work described in Item II above except DELETE North parking area: Remove asphalt, pavement, striping, and curb. Seed within removed parking limits. Reference Civil drawings.
- D. ITEM IV, ALTERNATE NO. 3: Perform all work described in Item III above except DELETE fall deterrent from 2nd level: Eliminate wire metal mesh and associated supports on all sides of only the 2nd level.
- E. ITEM V, ALTERNATE NO. 4: Perform all work described in Item IV except DELETE planting by 100%: Reduce landscape plantings as indicated on drawings.
- F. ITEM VI, ALTERNATE NO. 5: Perform all work described in Item V except DELETE thin set brick: Deduct thin-set brick from entire project. Provide PS-1 BUFF/TAN integral color precast concrete with 1-1/2" revels as indicated on drawings.
- G. ITEM VII ALTERNATE NO. 6: Perform all work described in Item VI except DELETE Canopy Connector: Remove canopy and associated structure, rainwater gutter system, lighting system, concrete walkway to remain.
- H. ITEM VIII ALTERNATE NO. 7: Perform all work described in Item VII except DELETE Fall Deterrent Complete: Remove all remaining wire metal mesh in the project and associated supports.
- I. ITEM IX ALTERNATE NO. 8: Perform all work described in Item VIII except DELETE South Elevator (Shaft to remain): Eliminate elevator #2 and its corresponding equipment and signals. Construct elevator shaft, hoist beam and other architectural and structural elements as per drawings and specifications. Provide a continuous precast panel with ¼" revels at openings as originally indicated, to match the surrounding wall and in such a way that can cleanly be reopened at future installation time. Elevator #1 to remain fully operational.
- J. ITEM X ALTERNATE NO. 9: Perform all work described in Item IX except DELETE Partial Third Floor (between column lines 1-4 to B-C): Remove concrete barrier wall, wire metal mesh and concrete spandrel panel along column line B between columns lines 1-4 and along column line 1 between column lines B-C at level 3. Reduce height of columns along column line B between column lines 1-4.

- K. ITEM XI ALTERNATE NO. 10: Perform all work described in Item X except DELETE Partial Third Floor (between column lines 1-9 to C-D): Deduct one level from both egress/stair towers and elevator tower. Add simple stair from level 2 to level 3 along column line B between column lines 7-8. Modify concrete barrier wall along column B. At level 3, remove wire metal mesh and concrete spandrel panel along column D between column line 1-9 and along column lines 1 and 9 between column lines B-D. Reduce top of concrete columns along column line D between column lines 1-9 and column lines 1 and 9 between C-D to an elevation of 120'-10". Reduce height of columns at column line B1 and B2 to an elevation of 120'-10".

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. AFTER AWARD OF CONTRACT, digital PDF sets of specifications and drawings will be furnished.
- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all 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.

D. Key Control:

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

E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.

6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
 - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
 - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

F. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. Separate permits shall be issued for General Contractor and its employees for parking in designated areas only. There will be no parking allowed on grass.

1.5 FIRE SAFETY

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

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

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

2. National Fire Protection Association (NFPA):

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

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

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

70-2011.....National Electrical Code

101-2012.....Life Safety Code

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

3. Occupational Safety and Health Administration (OSHA):

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

4. VHA Directive 2005-007

- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COR for review for compliance with VHA Directive 2005-007, NFPA 101 and NFPA 241. Prior to beginning work, all employees of the contractor and/or any subcontractors shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Provide documentation to the Resident Engineer that all construction workers have undergone contractor's safety briefing.
- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Construction Partitions:
3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.

- F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COR.
- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR.
- I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- K. Standpipes: Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241.
- M. Existing Fire Protection: Do not impair automatic sprinklers, hydrants, 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 Resident Engineer.
- N. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR.
- O. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR. Obtain permits from facility at least 48 hours in advance.
- P. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR.

- Q. 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.
- R. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- S. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- T. If required, submit documentation to the Resident Engineer that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor

shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(FAR 52.236-10)

- D. Working space and space available for storing materials is indicated as lay-down area on the drawings.
- E. Execute work in such a manner as to interfere as little as possible with work being done by others. Keep roads clear of construction materials, debris, standing construction equipment and vehicles at all times.
- 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.
- F. 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 Resident Engineer. All such actions shall be coordinated with the Utility Company involved:
 - 1. 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.

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

1. Phase I:

- a. During this phase, the Contractor shall demolish the existing 1 story building, pavement, landscaping, and site features in preparation for new service road along the North and East sides of the proposed garage. Construct service road and utilities in this area. End state of this phase will be the completion of the new service drive with connections on the Northeast and Northwest ends of the roadway. Connection to the southeast will occur in phase 2. Open roadway to thru traffic from East and West connection points. Contractor can commence phase 2 and adjust construction fence accordingly once the VA's COR has approved work within phase 1.

2. Phase II:

- a. During this phase, the Contractor will demolish existing pavement, landscaping, and site features in preparation for new service road Southeast of the proposed garage. Contractor to maintain access Monday through Friday, 8 AM to 5 PM to the existing parking lots along the East side of this roadway. Access to these lots can be completely shut off during weekend hours. Contractor to schedule construction activities in this area with the COR for final approval of accessibility and maintenance of traffic plan. The end state of this phase is a completed roadway that connects vehicular flow from the Southeast corner of the proposed garage to the Northwest corner. Vehicular flow will be maintained along this new roadway throughout the remaining duration of the construction of the parking garage structure. Contractor can commence phase

3 and adjust construction fence accordingly once the VA's COR has approved work within phase 2.

3. Phase III

- a. During this phase, the Contractor will complete the demolition of existing pavement, landscaping, and site features in preparation for new parking garage. The contractor will construct all work identified with the new parking structure. Traffic will be maintained on the newly constructed loop road. The contractor will also complete all ancillary work to finish the construction project inclusive of sidewalks, roadway connections, top coat of asphalt, striping, and plantings/landscape.

- 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 Resident Engineer.
- J. When a building is turned over to Contractor, Contractor shall accept entire responsibility therefore.
 - 1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
 - 2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or 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 Resident Engineer.

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 Resident Engineer. 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 Resident Engineer, 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 Resident Engineer.
5. In case of a contract construction emergency, service will be interrupted on approval of Resident Engineer. 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. Ensure any vacated wires in conduits are removed. Lines where indicated on plans will require filling with flowable grout. 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 Resident Engineer.
- N. Coordinate the work for this contract with other construction operations as directed by Resident Engineer. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.8 INFECTION PREVENTION MEASURES

- A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including

periodic status reports, and submit to COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

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

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

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

1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by Resident Engineer. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.

E. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.

2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

1.9 DISPOSAL AND RETENTION

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
1. Reserved items which are to remain property of the Government are 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 Resident Engineer.
 2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
 3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.
 4. PCB Transformers and Capacitors: The Contractor shall be responsible for disposal of the Polychlorinated Biphenyl (PCB) transformers and capacitors. The transformers and capacitors shall be taken out of service and handled in accordance with the procedures of the Environmental Protection Agency (EPA) and the Department of Transportation (DOT) as outlined in Code of Federal Regulation (CFR), Titled 40 and 49 respectively. The EPA's Toxic Substance Control Act (TSCA) Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7 also apply. Upon removal of PCB transformers and capacitors for disposal, the "originator" copy of the Uniform Hazardous Waste Manifest (EPA Form 8700-22), along with the Uniform Hazardous Waste Manifest Continuation Sheet (EPA Form 8700-22A) shall be returned to the

Contracting Officer who will annotate the contract file and transmit the Manifest to the Medical Center's Chief.

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

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

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

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

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

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

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

49 CFR 173.....Subpart A General

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

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

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

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

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the

careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

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

(FAR 52.236-9)

- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.
- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. 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.

1.11 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the Resident Engineer. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the Resident Engineer before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.12 PHYSICAL DATA

A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by Terracon Consultants Inc. Raleigh, North Carolina.

(FAR 52.236-4)

B. Subsurface conditions have been developed by core borings and test pits. Logs of subsurface exploration are shown diagrammatically on drawings.

C. A copy of the soil report is included in the specifications and shall be considered part of the contract documents.

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

1.13 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.

1.14 LAYOUT OF WORK

A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to

lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(FAR 52.236-17)

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

request furnish to the Resident Engineer certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.

1. Lines of each building and/or addition.
2. Elevations of bottoms of footings and tops of floors of each building and/or addition.
3. Lines and elevations of sewers and of all outside distribution systems.

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 Resident 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".

1.15 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 Resident Engineer's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the Resident Engineer within 15 calendar days after each completed phase and after the acceptance of the project by the Resident Engineer.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.16 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the Resident Engineer, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's

expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

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

1.17 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
 - 1. Permission to use each unit or system must be given by Resident Engineer. If the equipment is not installed and maintained in accordance with the following provisions, the Resident Engineer will withdraw permission for use of the equipment.
 - 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
 - 3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 - 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.

5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
 6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

1.18 TEMPORARY USE OF NEW ELEVATORS

- A. The Contractor and his personnel shall be permitted use of new elevator(s) subject to the following provisions:
1. Contractor shall make arrangements with the Resident Engineer for use of elevator(s). Contractor may obtain elevator(s) for exclusive use.
 2. Prior to the use of elevator(s), the Contractor shall have the elevator(s) inspected and accepted by an ASME accredited, certified elevator safety inspector. The acceptance report shall be submitted to the Resident Engineer.
 3. Submit to the Resident Engineer the schedule and procedures for maintaining equipment. Indicate the day or days of the week and total hours required for maintenance. A report shall be submitted to the Resident Engineer monthly indicating the type of maintenance conducted, hours used, and any repairs made to the elevator(s).
 4. The Contractor shall be responsible for enforcing the maintenance procedures.
 5. During temporary use of elevator(s) all repairs, equipment replacement and cost of maintenance shall be the responsibility of the Contractor.

6. Personnel for operating elevator(s) shall not be provided by the Department of Veterans Affairs.
7. Contractor shall cover and provide maximum protection of the entire elevator(s) installation.
8. The Contractor shall arrange for the elevator company to perform operation of the elevator(s) so that an ASME accredited, certified elevator safety inspector can evaluate the equipment. The Contractor shall be responsible for any costs of the elevator company.
9. All elevator(s) parts worn or damaged during temporary use shall be removed and replaced with new parts. This shall be determined by an ASME accredited certified elevator safety inspector after temporary use and before acceptance by the Government. Submit report to the Resident Engineer for approval.
10. Elevator shall be tested as required by the testing section of the elevator(s) specifications before acceptance by the Department of Veterans Affairs.

1.19 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 Resident Engineer, 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.

1.20 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 as recommended by manufacturer.
- E. Electricity (for Construction and Testing): Furnish all temporary electric services.
- 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 Resident Engineer'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 Resident Engineer'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.

1.21 NEW TELEPHONE EQUIPMENT

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

1.22 TESTS

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

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

1.23 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals and one compact disc (four hard copies and one electronic copy 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 Resident Engineer, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.24 GOVERNMENT-FURNISHED PROPERTY

- A. The Government shall deliver to the Contractor, the Government-furnished property shown and clearly indicated on the drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.
- C. Storage space for equipment will be provided by the Government and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Medical Center.
- D. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.
 - 1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
 - 2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.
- E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make

the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.

- F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.25 RELOCATED ITEMS

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

1.26 CONSTRUCTION SIGN

- A. Provide a Construction Sign where directed by the Resident Engineer. All wood members shall be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or

equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed.

- B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.
- C. Maintain sign and remove it when directed by the Resident Engineer.
- D. Detail Drawing of construction sign showing required legend and other characteristics of sign is shown on the drawings.

1.27 SAFETY SIGN

- A. Provide a Safety Sign where directed by Resident Engineer. Face of sign shall be 19 mm (3/4 inch) thick exterior grade plywood. Provide two 100 mm by 100 mm (four by four inch) posts extending full height of sign and 900 mm (three feet) into ground. Set bottom of sign level at 1200 mm (four feet) above ground.
- B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted.
- C. Maintain sign and remove it when directed by Resident Engineer.
- D. Standard Detail Drawing Number SD10000-02(Found on VA TIL) of safety sign showing required legend and other characteristics of sign is shown on the drawings.
- E. Post the number of accident free days on a daily basis.

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

- 1.1 Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR (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 Contracting Officer Representative 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 other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
- B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail, email 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 Contracting Officer Representative and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
 4. Contractor shall forward a copy of transmittal letter to Contracting Officer Representative simultaneously with submission to a commercial testing laboratory.
 5. A Copy of Laboratory test reports shall be sent directly to Contracting Officer Representative for appropriate action.
 6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
 7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- 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 Contracting Officer Representative 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** Samples (except laboratory samples), shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

Guidon Design Inc.

905 N. Capitol Ave. Suite 100

Indianapolis, IN. 46204

Salisbury VAMC
Construct New Parking Garage
Salisbury, NC 28144

Project No. 659-342

1.11 At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the Contracting Officer Representative.

1.12 Samples (except laboratory samples) for approval shall be sent to Architect-Engineer, in care of Contracting Officer Representative

Steve Landis, COR

SALISBURY VA MEDICAL CENTER

W.G. "Bill" Hefner VAMC

1601 Brenner Avenue

Salisbury, NC 28144

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SECTION 01 35 26
SAFETY REQUIREMENTS

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SECTION 01 35 26
SAFETY REQUIREMENTS

1.1 APPLICABLE PUBLICATIONS:

- A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.
- B. American Society of Safety Engineers (ASSE):
 - A10.1-2011.....Pre-Project & Pre-Task Safety and Health Planning
 - A10.34-2012.....Protection of the Public on or Adjacent to Construction Sites
 - A10.38-2013.....Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment American National Standard Construction and Demolition Operations
- C. American Society for Testing and Materials (ASTM):
 - E84-2013.....Surface Burning Characteristics of Building Materials
- D. The Facilities Guidelines Institute (FGI):
 - FGI Guidelines-2010Guidelines for Design and Construction of Healthcare Facilities
- E. National Fire Protection Association (NFPA):
 - 10-2013.....Standard for Portable Fire Extinguishers
 - 30-2012.....Flammable and Combustible Liquids Code
 - 51B-2014.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
 - 70-2014.....National Electrical Code
 - 70B-2013.....Recommended Practice for Electrical Equipment Maintenance
 - 70E-2012Standard for Electrical Safety in the Workplace
 - 99-2012.....Health Care Facilities Code
 - 241-2013.....Standard for Safeguarding Construction, Alteration, and Demolition Operations
- F. The Joint Commission (TJC)
 - TJC ManualComprehensive Accreditation and Certification Manual
- G. U.S. Nuclear Regulatory Commission
 - 10 CFR 20Standards for Protection Against Radiation

H. U.S. Occupational Safety and Health Administration (OSHA):

29 CFR 1904Reporting and Recording Injuries & Illnesses

29 CFR 1910Safety and Health Regulations for General
Industry

29 CFR 1926Safety and Health Regulations for Construction
Industry

CPL 2-0.124.....Multi-Employer Citation Policy

I. VHA Directive 2005-007

1.2 DEFINITIONS:

- A. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).
- B. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.
- C. High Visibility Accident. Any mishap which may generate publicity or high visibility.
- D. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.
- E. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:
 - 1. Death, regardless of the time between the injury and death, or the length of the illness;
 - 2. Days away from work (any time lost after day of injury/illness onset);
 - 3. Restricted work;
 - 4. Transfer to another job;
 - 5. Medical treatment beyond first aid;
 - 6. Loss of consciousness; or
 - 7. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

1.3 REGULATORY REQUIREMENTS:

- A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable [federal, state, and local] laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Contracting Officer Representative.

1.4 ACCIDENT PREVENTION PLAN (APP):

- A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.
- B. The APP shall be prepared as follows:
1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.
 2. Address both the Prime Contractors and the subcontractors work operations.
 3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.
 4. Address all the elements/sub-elements and in order as follows:
 - a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:

- 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
 - 2) Plan approver (company/corporate officers authorized to obligate the company);
 - 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
- b. **BACKGROUND INFORMATION.** List the following:
- 1) Contractor;
 - 2) Contract number;
 - 3) Project name;
 - 4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
- c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.
- d. **RESPONSIBILITIES AND LINES OF AUTHORITIES.** Provide the following:
- 1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;
 - 2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.
 - 3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.;
 - 4) Requirements that no work shall be performed unless a designated competent person is present on the job site;
 - 5) Requirements for pre-task Activity Hazard Analysis (AHAs);
 - 6) Lines of authority;

- 7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;
- e. SUBCONTRACTORS AND SUPPLIERS.** If applicable, provide procedures for coordinating SOH activities with other employers on the job site:
 - 1) Identification of subcontractors and suppliers (if known);
 - 2) Safety responsibilities of subcontractors and suppliers.
- f. TRAINING.**
 - 1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
 - 2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc...) and any requirements for periodic retraining/recertification are required.
 - 3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
 - 4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)
- g. SAFETY AND HEALTH INSPECTIONS.**
 - 1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.
 - 2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)
- h. ACCIDENT INVESTIGATION & REPORTING.** The Contractor shall conduct mishap investigations of all OSHA Recordable Incidents. The APP shall include accident/incident investigation procedure & identify person(s) responsible to provide the following to the Contracting Officer Representative:

- 1) Exposure data (man-hours worked);
- 2) Accident investigations, reports, and logs.

i. PLANS (PROGRAMS, PROCEDURES) REQUIRED. Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational risks in site-specific compliance and accident prevention plans. These Plans shall include but are not be limited to procedures for addressing the risks associates with the following:

- 1) Emergency response ;
- 2) Contingency for severe weather;
- 3) Fire Prevention ;
- 4) Medical Support;
- 5) Posting of emergency telephone numbers;
- 6) Prevention of alcohol and drug abuse;
- 7) Site sanitation (housekeeping, drinking water, toilets);
- 8) Night operations and lighting ;
- 9) Hazard communication program;
- 10) Welding/Cutting "Hot" work ;
- 11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
- 12) General Electrical Safety
- 13) Hazardous energy control (Machine LOTO);
- 14) Site-Specific Fall Protection & Prevention;
- 15) Excavation/trenching;
- 16) Asbestos abatement;
- 17) Lead abatement;
- 18) Crane Critical lift;
- 19) Respiratory protection;
- 20) Health hazard control program;
- 21) Radiation Safety Program;
- 22) Abrasive blasting;
- 23) Heat/Cold Stress Monitoring;
- 24) Crystalline Silica Monitoring (Assessment);
- 25) Demolition plan (to include engineering survey);
- 26) Formwork and shoring erection and removal;
- 27) PreCast Concrete.

C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33

23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

- D. Once accepted by the Contracting Officer Representative, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.
- E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safeworking conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34) and the environment.

1.5 ACTIVITY HAZARD ANALYSES (AHAS):

- A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site)
- B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.
- C. Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
 - 1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA.

- Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.
2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).
 - a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
 - b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.
 3. Submit AHAs to the Contracting Officer for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.
 4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.
 5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the Contracting Officer Representative.

1.6 PRECONSTRUCTION CONFERENCE:

- A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its

implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.

- B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.
- C. Deficiencies in the submitted APP will be brought to the attention of the Contractor within 14 days of submittal, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

1.7 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP):

- A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.
- B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as

part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.

- E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

1.8 TRAINING:

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.
- B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 3 years.
- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.
- E. Submit training records associated with the above training requirements to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance.
- F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or

his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the Resident Engineer that individuals have undergone contractor's safety briefing.

- G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

1.9 INSPECTIONS:

- A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of the their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.
- B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT can be a corporate safety professional or independently contracted. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.
1. Results of the inspection will be documented with tracking of the identified hazards to abatement.
 2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.
 3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.
 4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

1.10 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:

- A. Notify the Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of OSHA Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$5,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer Representative determine whether a government investigation will be conducted.
- B. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162, and provide the report to the Contracting Officer Representative within 5 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.
- C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative monthly.
- D. A summation of all OSHA recordable accidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative as requested.

1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE):

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:
 - 1. Hard Hats - unless written authorization is given by the Contracting Officer Representative in circumstances of work operations that have limited potential for falling object hazards such as during

- finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.
2. Safety glasses - unless written authorization is given by the Contracting Officer Representative appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
 3. Appropriate Safety Shoes - based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the Contracting Officer Representative.
 4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

1.12 INFECTION CONTROL

- A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. Exterior construction activities causing disturbance of soil or creates dust in some other manner must be controlled.
- B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the Contracting Officer Representative before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the Contracting Officer Representative. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The primary project scope area for this project is: **Class 1**, however, work outside the primary project scope area may vary.

The required infection control precautions with each class are as follows:

1. Class I requirements:

a. During Construction Work:

- 1) Execute work by methods to minimize raising dust from construction operations.

b. Upon Completion:

- 1) Clean work area upon completion

C. Products and Materials:

1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes

2. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose

3. Disinfectant: Hospital-approved disinfectant or equivalent product

D. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

E. A dust control program will be establish and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

F. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will 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 with safe thresholds established.

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

1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.

2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.
3. Adhesive Walk-off/Carpet Walk-off Mats 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.
4. 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 it is created. Transport these outside the construction area in containers with tightly fitting lids.
5. The contractor shall not haul debris through patient-care areas without prior approval of the Resident Engineer and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
7. 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.

I. 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.

J. Exterior Construction

1. Contractor shall verify that dust will not be introduced into the medical center through intake vents, or building openings. HEPA filtration on intake vents is required where dust may be introduced.
2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary
3. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.13 TUBERCULOSIS SCREENING

- A. Contractor shall provide written certification that all contract employees assigned to the work site have had a pre-placement tuberculin screening within 90 days prior to assignment to the worksite and been found have negative TB screening reactions. Contractors shall be required to show documentation of negative TB screening reactions for any additional workers who are added after the 90-day requirement before they will be allowed to work on the work site. NOTE: This can be the Center for Disease Control (CDC) and Prevention and two-step skin testing or a Food and Drug Administration (FDA)-approved blood test.
 1. Contract employees manifesting positive screening reactions to the tuberculin shall be examined according to current CDC guidelines prior to working on VHA property.
 2. Subsequently, if the employee is found without evidence of active (infectious) pulmonary TB, a statement documenting examination by a physician shall be on file with the employer (construction contractor), noting that the employee with a positive tuberculin screening test is without evidence of active (infectious) pulmonary TB.
 3. If the employee is found with evidence of active (infectious) pulmonary TB, the employee shall require treatment with a subsequent statement to the fact on file with the employer before being allowed to return to work on VHA property.

1.14 FIRE SAFETY

- A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer

Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.

- 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 Contracting Officer Representative .
- F. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.
- 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.
- J. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer Representative. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Resident Engineer.
- N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Contracting Officer Representative. Obtain permits from Contracting Officer Representative

at least 48 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

- O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.
- P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

1.15 ELECTRICAL

- A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J - General Environmental Controls, 29 CFR Part 1910 Subpart S - Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.
- B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.
- C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted. The Contracting Officer Representative with approval of the Medical Center Director will make the determination if the circumstances would meet the exception outlined above. An AHA specific to energized work activities will be developed, reviewed, and accepted prior to the start of that work.
 - 1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work

- involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.
2. Verification of the absence of voltage after de-energization and lockout/tagout is considered "energized electrical work" (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.
 3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Contracting Officer Representative
- D.** Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alternative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
- E.** Ground-fault circuit interrupters. All 120-volt, single-phase 15- and 20-ampere receptacle outlets on construction sites shall have approved ground-fault circuit interrupters for personnel protection. "Assured Equipment Grounding Conductor Program" only is not allowed.

1.16 FALL PROTECTION

- A. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.
1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
 2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.

3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.
4. Fall protection while using a ladder will be governed by the OSHA requirements.

1.17 SCAFFOLDS AND OTHER WORK PLATFORMS

- A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.
- B. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) as stated in Section 1.16.
- C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.
 1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.
 2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.
 3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.
 4. Emergency descent devices shall not be used as working platforms.
- D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:
 1. The Competent Person's name and signature;
 2. Dates of initial and last inspections.
- E. Mast Climbing work platforms: When access ladders, including masts designed as ladders, exceed 20 ft (6 m) in height, positive fall protection shall be used.

1.18 EXCAVATION AND TRENCHES

- A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P.

B. All excavations and trenches 5 feet in depth or greater shall require a written trenching and excavation permit (NOTE - some States and other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall be completed and provided to the Contracting Officer Representative prior to commencing work for the day. At the end of the day, the permit shall be closed out and provided to the Contracting Officer Representative. The permit shall be maintained onsite and include the following:

1. Determination of soil classification
2. Indication that utilities have been located and identified. If utilities could not be located after all reasonable attempt, then excavating operations will proceed cautiously.
3. Indication of selected excavation protective system.
4. Indication that the spoil pile will be stored at least 2 feet from the edge of the excavation and safe access provided within 25 feet of the workers.
5. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere.

C. If not using an engineered protective system such as a trench box, shielding, shoring, or other Professional Engineer designed system and using a sloping or benching system, soil classification cannot be Solid Rock or Type A. All soil will be classified as Type B or Type C and sloped or benched in accordance with Appendix B of 29 CFR 1926.

1.19 CRANES

- A. All crane work shall comply with 29 CFR 1926 Subpart CC.
- B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no "Phase In" date of November 10, 2014.
- C. A detailed lift permit shall be submitted 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing. The lift will not be allowed without approval of this document.
- D. Crane operators shall not carry loads
1. over the general public or VAMC personnel
 2. over any occupied building unless
 - a. the top two floors are vacated

- b. or overhead protection with a design live load of 300 psf is provided

1.20 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

- A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment [1926.702(j)], heavy machinery & equipment [1926.600(a)(3)(i)], and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA 70E and other VA specific requirements discussed in the section.

1.21 CONFINED SPACE ENTRY

- A. All confined space entry shall comply with 29 CFR 1910.146 except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].
- B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the Contracting Officer Representative

1.22 WELDING AND CUTTING

As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Contracting Officer Representative. Obtain permits from Contracting Officer Representative at least 48 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

1.23 LADDERS

- A. All Ladder use shall comply with 29 CFR 1926 Subpart X.
- B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels shall be in place on ladders
- D. Step Ladders shall not be used in the closed position
- E. Top steps or cap of step ladders shall not be used as a step
- F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.
 - 1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.

2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.

G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

1.24 FLOOR & WALL OPENINGS

- A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.
- B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. See 21.F for covering and labeling requirements. Skylights located in floors or roofs are considered floor or roof hole/openings.
- C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toeboards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.
 1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
 2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.
 3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.
 4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
 5. Workers are prohibited from standing/walking on skylights.

- - - E N D - - -

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:

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

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

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

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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

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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.cpmc.org
CRA	California Redwood Association http://www.calredwood.org
CRSI	Concrete Reinforcing Steel Institute http://www.crsi.org

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

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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

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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

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RIS Redwood Inspection Service
See - CRA

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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

Salisbury VAMC
Construct New Parking Garage
Salisbury, NC 28144

Project No. 659-342

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 by General 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):
 - T27-11.....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
 - T96-02 (R2006).....Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
 - T104-99 (R2007).....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
 - T180-10.....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
 - T191-02(R2006).....Standard Method of Test for 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):
 - A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - A370-12.....Standard Test Methods and Definitions for Mechanical Testing of Steel Products
 - A416/A416M-10.....Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

A490-12.....Standard Specification for Heat Treated Steel
Structural Bolts, 150 ksi Minimum Tensile
Strength

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

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

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

C109/C109M-11b.....Standard Test Method for Compressive Strength of
Hydraulic Cement Mortars

C136-06.....Standard Test Method for Sieve Analysis of Fine
and Coarse Aggregates

C138/C138M-10b.....Standard Test Method for Density (Unit Weight),
Yield, and Air Content (Gravimetric) of Concrete

C140-12.....Standard Test Methods for Sampling and Testing
Concrete Masonry Units and Related Units

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

C172/C172M-10.....Standard Practice for Sampling Freshly Mixed
Concrete

C173/C173M-10b.....Standard Test Method for Air Content of freshly
Mixed Concrete by the Volumetric Method

C330/C330M-09.....Standard Specification for Lightweight
Aggregates for Structural Concrete

C567/C567M-11.....Standard Test Method for Density Structural
Lightweight Concrete

C780-11.....Standard Test Method for Pre-construction and
Construction Evaluation of Mortars for Plain and
Reinforced Unit Masonry

C1019-11.....Standard Test Method for Sampling and Testing
Grout

C1064/C1064M-11.....Standard Test Method for Temperature of Freshly
Mixed Portland Cement Concrete

C1077-11c.....Standard Practice for Agencies Testing Concrete
and Concrete Aggregates for Use in Construction
and Criteria for Testing Agency Evaluation

C1314-11a.....Standard Test Method for Compressive Strength of
Masonry Prisms

D422-63(2007).....Standard Test Method for Particle-Size Analysis
of Soils

D698-07e1.....Standard Test Methods for Laboratory Compaction
Characteristics of Soil Using Standard Effort

D1140-00(2006).....Standard Test Methods for Amount of Material in
Soils Finer than No. 200 Sieve

D1143/D1143M-07e1.....Standard Test Methods for Deep Foundations Under
Static Axial Compressive Load

D1188-07e1.....Standard Test Method for Bulk Specific Gravity
and Density of Compacted Bituminous Mixtures
Using Coated Samples

D1556-07.....Standard Test Method for Density and Unit Weight
of Soil in Place by the Sand-Cone Method

D1557-09.....Standard Test Methods for Laboratory Compaction
Characteristics of Soil Using Modified Effort
(56,000ft lbf/ft³ (2,700 KNm/m³))

D2166-06.....Standard Test Method for Unconfined Compressive
Strength of Cohesive Soil

D2167-08).....Standard Test Method for Density and Unit Weight
of Soil in Place by the Rubber Balloon Method

D2216-10.....Standard Test Methods for Laboratory
Determination of Water (Moisture) Content of
Soil and Rock by Mass

D2974-07a.....Standard Test Methods for Moisture, Ash, and
Organic Matter of Peat and Other Organic Soils

D3666-11.....Standard Specification for Minimum Requirements
for Agencies Testing and Inspecting Road and
Paving Materials

D3740-11.....Standard Practice for Minimum Requirements for
Agencies Engaged in Testing and/or Inspection
of Soil and Rock as used in Engineering Design
and Construction

D6938-10.....Standard Test Method for In-Place Density and
Water Content of Soil and Soil-Aggregate by
Nuclear Methods (Shallow Depth)

E94-04(2010).....Standard Guide for Radiographic Examination

E164-08.....Standard Practice for Contact Ultrasonic Testing
of Weldments

E329-11c.....Standard Specification for Agencies Engaged in
Construction Inspection, Testing, or Special
Inspection

E543-09.....Standard Specification for Agencies Performing
Non-Destructive Testing

E605-93(R2011).....Standard Test Methods for Thickness and Density
of Sprayed Fire Resistive Material (SFRM)
Applied to Structural Members

E709-08.....Standard Guide for Magnetic Particle Examination

E1155-96(R2008).....Determining FF Floor Flatness and FL Floor
Levelness Numbers

E. American Welding Society (AWS):

D1.D1.1M-10.....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.; E329, C1077, D3666, D3740, A880, E543) 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 Contracting Officer Representative. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Contracting Officer Representative to such failure.

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

D. Verbal Reports: Give verbal notification to Contracting Officer Representative 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 Contracting Officer Representative regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Contracting Officer Representative 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 building areas and provide part 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. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698 and/or ASTM D1557.
2. Make field density tests in accordance with the primary testing method following ASTM D6938 wherever possible. Field density tests utilizing ASTM D1556 or ASTM D2167 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 Contracting Officer Representative before the tests are conducted.
 - a. Building Slab Subgrade: At least one test of subgrade for every 185 m² (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test

- for every 185 m² (2000 square feet) of overlaying building slab, but in no case fewer than three tests.
- b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
 - c. Pavement Subgrade: One test for each 335 m² (400 square yards), but in no case fewer than two tests.
 - d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
 - e. 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.
 - f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to Contracting Officer Representative. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- C. Fill and Backfill Material Gradation: One test per 1,000 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C136.
- D. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- E. Testing Materials: Test suitability of on-site and off-site borrow as directed by Contracting Officer Representative.

3.2 FOUNDATION PILES:

- A. Witness load test procedure for conformance with ASTM D1143 and interpret test data to verify geotechnical recommendations for pile capacity. Submit load test report in accordance with ASTM D1143.
- B. Review Contractor's equipment, methods, and procedures prior to starting any work on site. Provide continuous inspection of pile installation. Maintain a record of all pertinent phases of operation for submittal to Contracting Officer Representative.
- C. Auger-Placed Piles: Take and test samples of grout in accordance with ASTM C109 for conformance with specified strength requirements. Not less

than six cubes shall be made for each day of casting. Test three cubes at 7 days and three at 28 days.

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 Contracting Officer Representative.

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 state 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 CONCRETE:

- A. Batch Plant Inspection and Materials Testing:

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of Contracting Officer Representative with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by Contracting Officer Representative.
2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to Contracting Officer Representative.
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 m³ (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. Contracting Officer Representative 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 m³ (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m³ (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 Contracting Officer Representative 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 Contracting Officer Representative. 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 Contracting Officer Representative. 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/m³ (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.

3.8 REINFORCEMENT:

- A. Review mill test reports furnished by Contractor. Perform sampling at fabricating plant. Take two samples from each 23 t (25 tons) or fraction thereof of each size of reinforcing steel No. 10 thru No. 57 (No. 3 thru No. 18).
- B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.
- C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- D. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

3.9 SHOTCRETE:

- A. Inspection and Material Testing:
 1. Provide field inspection and testing service as required by Contracting Officer Representative to certify that shotcrete has been applied in accordance with contract documents.
 2. Periodically inspect and test proportioning equipment for accuracy and report deficiencies to Contracting Officer Representative.
 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. Report instances of excessive moisture to Contracting Officer Representative.
 5. Certify, in duplicate, that ingredients and proportions and amounts of ingredients in shotcrete conform to approved trial mixes.

6. Provide field inspection of the proper size and placement of the reinforcement in the shotcrete.

B. Shotcrete Sampling:

1. Provide a technician at site of placement to perform shotcrete sampling.
2. Take cores in accordance with ACI 506.
3. Insure maintenance of water-cement ratio established by approved trial mix.
4. Verify specified mixing has been accomplished.

C. Laboratory Tests of Field Sample Panels:

1. Compression test core for strength in accordance with ACI 506. For each test series of three cores, test one core at 7 days and one core at 28 days. Use remaining core as a spare to be tested at either 7 or 28 days as required. Compile laboratory test reports as follows:
Compressive strength test shall be result of one core, except when one core shows evidence of improper sampling or testing, in which case it shall be discarded and strength of spare core shall be used.
2. Submit certified compression test reports (duplicate) to Contracting Officer Representative. On test report, indicate following information:
 - a. Core identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Compressive strength of shotcrete in MPa (psi).
 - d. Weather conditions during placing.
 - e. Temperature of shotcrete in each test core when test core was taken.
 - f. Maximum and minimum ambient temperature during placing.
 - g. Ambient temperature when shotcrete sample was taken.
 - h. Date delivered to laboratory and date tested.

- D. Submit inspection reports certification and instances of noncompliance to Contracting Officer Representative.

3.10 PRESTRESSED CONCRETE:

- A. Inspection at Plant: Forms, placement and concrete cover of reinforcing steel and tendons, placement and finishing of concrete, and tensioning of tendons.
- B. Concrete Testing: Test concrete including materials for concrete required in Article, CONCRETE of this section, except make two test

cylinders for each day's production of each strength of concrete produced.

- C. Test tendons for conformance with ASTM A416 and furnish report to Contracting Officer Representative.
- D. Inspect members to insure that specification requirements for curing and finishes have been met.

3.11 ARCHITECTURAL PRECAST CONCRETE:

- A. Inspection at Plant: Forms, placement of reinforcing steel, concrete cover, and placement and finishing of concrete.
- B. Concrete Testing: Test concrete including materials for concrete as required in Article CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.
- C. Inspect members to insure specification requirements for curing and finishes have been met.

3.12 MASONRY:

- A. Mortar Tests:
 - 1. Laboratory compressive strength test:
 - a. Comply with ASTM C780.
 - b. Obtain samples during or immediately after discharge from batch mixer.
 - c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
 - d. Test one sample at 7 days and 2 samples at 28 days.
 - 2. Two tests during first week of operation; one test per week after initial test until masonry completion.
- B. Grout Tests:
 - 1. Laboratory compressive strength test:
 - a. Comply with ASTM C1019.
 - b. Test one sample at 7 days and 2 samples at 28 days.
 - c. Perform test for each 230 m² (2500 square feet) of masonry.
- C. Masonry Unit Tests:
 - 1. Laboratory Compressive Strength Test:
 - a. Comply with ASTM C140.
 - b. Test 3 samples for each 460 m² (5000 square feet) of wall area.
- D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m² (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

3.13 STRUCTURAL STEEL:

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Prefabrication Inspection:
 - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
 - 2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
 - 3. Approve welder qualifications by certification or retesting.
 - 4. Approve procedure for control of distortion and shrinkage stresses.
 - 5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
- C. Fabrication and Erection:
 - 1. Weld Inspection:
 - a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
 - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
 - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.
 - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
 - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
 - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
 - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.

- g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
 - h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
 - i. Verify that correction of rejected welds are made in accordance with AWS D1.1.
 - j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
 - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
 - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to Contracting Officer Representative.

3.14 STEEL DECKING:

- A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."
- C. Submit inspection reports, certification, and instances of noncompliance to Contracting Officer Representative.

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

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

7. Sanitary Wastes:

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

1.2 QUALITY CONTROL

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

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328.....Definitions

1.4 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the COR 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 COR for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
 - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
 - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
 - d. Description of the Contractor's environmental protection personnel training program.
 - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's

proposed operations and the requirements imposed by those laws, regulations, and permits.

- f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
 - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
 - h. Permits, licenses, and the location of the solid waste disposal area.
 - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
 - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
 - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the COR. 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.
 - a. Reuse or conserve the collected topsoil sediment as directed by the COR.
 - b. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation

- basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
6. Manage borrow areas on Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
 7. Manage and control spoil areas on Government property to limit spoil to areas on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
 8. Protect adjacent areas from despoilment by temporary excavations and embankments.
 9. 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.
 10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 11. Handle discarded materials other than those included in the solid waste category as directed by the COR.
- 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.
- 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.
- 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 COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75
 2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
 - a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

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

- b. Use shields or other physical barriers to restrict noise transmission.
 - c. Provide soundproof housings or enclosures for noise-producing machinery.
 - d. Use efficient silencers on equipment air intakes.
 - e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - f. Line hoppers and storage bins with sound deadening material.
 - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. COR
- 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 COR. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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SECTION 01 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 recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org/tools/cwm.php> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

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

1.4 TERMINOLOGY

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

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

1.5 SUBMITTALS

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

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

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

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

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

1.6 APPLICABLE PUBLICATIONS

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

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

LEED Green Building Rating System for New Construction

1.7 RECORDS

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 COLLECTION

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

3.2 DISPOSAL

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

3.3 REPORT

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

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

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SECTION 01 81 11

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

This Section describes general requirements and procedures to comply with the Guiding Principles for Leadership in High Performance and Sustainable Buildings Memorandum of Understanding incorporated in the Executive Orders 13423 and 13514; Energy Policy Act of 2005 (EPA 2005) and the Energy Independence and Security Act of 2007 (EISA 2007).

1.2 OBJECTIVES

- A. To maximize resource efficiency and reduce the environmental impacts of construction and operation, the Contractor during the construction phase of this project shall implement the following procedures:
 - 1. Select products that minimize consumption of energy, water and non-renewable resources, while minimizing the amounts of pollution resulting from the production and employment of building technologies. It is the intent of this project to conform with EPA's Five Guiding Principles on environmentally preferable purchasing. The five principles are:
 - a. Include environmental considerations as part of the normal purchasing process.
 - b. Emphasize pollution prevention early in the purchasing process.
 - c. Examine multiple environmental attributes throughout a product's or service's life cycle.
 - d. Compare relevant environmental impacts when selecting products and services.
 - e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
 - 2. Control sources for potential Indoor Air Quality (IAQ) pollutants by controlled selection of materials and processes used in project construction in order to attain superior IAQ.
 - 3. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Construction Documents. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the work of this Contract and in

proposing product substitutions and/or changes to specified processes.

4. Use building practices that insure construction debris and particulates do not contaminate or enter duct work prior to system startup and turn over.

1.3 RELATED DOCUMENTS

- A. Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT
- B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS

1.4 DEFINITIONS

- A. Agrifiber Products: Composite panel products derived from agricultural fiber
- B. Biobased Product: As defined in the 2002 Farm Bill, a product determined by the Secretary to be a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials
- C. Biobased Content: The weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight
- D. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that it was obtained from forests certified by a specified certification program
- E. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder
- F. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Contractor as defined in Section 01 74 19.
- G. Third Party Certification: Certification of levels of environmental achievement by nationally recognized sustainability rating system.
- H. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where it inhibits view of the night sky
- I. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock

- J. Post-Consumer Recycled Content: The percentage by weight of constituent materials that have been recovered or otherwise diverted from the solid-waste stream after consumer use
- K. Pre-Consumer Recycled Content: Materials that have been recovered or otherwise diverted from the solid-waste stream during the manufacturing process. Pre-consumer content must be material that would not have otherwise entered the waste stream as per Section 5 of the FTC Act, Part 260 "Guidelines for the Use of Environmental Marketing Claims": www.ftc.gov/bcp/grnrule/guides980427
- L. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 250 miles (400 km) from the Project site
- M. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without being manufactured
- N. Sealant: Any material that fills and seals gaps between other materials
- O. Type 1 Finishes: Materials and finishes which have a potential for short-term levels of off gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high level of particulate matter in the process of installation and/or curing.
- P. Type 2 Finishes: "Fuzzy" materials and finishes which are woven, fibrous, or porous in nature and tend to adsorb chemicals offgas
- Q. Volatile Organic Compounds (VOCs): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible photochemical reactivity, listed in EPA 40 CFR 51.100(s), are also excluded from this regulatory definition.

1.5 SUBMITTALS

- A. Sustainable Design Submittals:
 - 1. Alternative Transportation: Provide manufacturer's cut sheets for all bike racks installed on site, including the total number of bicycle storage slots provided. Also, provide manufacturer's cut sheets for any alternative-fuel refueling stations installed on site, including fueling capacity information for an 8-hour period.
 - 2. Heat Island Effect:

- a. Site Paving: Provide manufacturer's cut sheets for all impervious paving materials, highlighting the Solar Reflectance Index (SRI) of the material. Also, provide cut sheets for all pervious paving materials.
 - b. Roofing Materials: Submittals for roofing materials must include manufacturer's cut sheets or product data highlighting the Solar Reflectance Index (SRI) of the material.
3. Exterior Lighting Fixtures: Submittals must include cut sheets with manufacturer's data on initial fixture lumens above 90° from nadir for all exterior lighting fixtures, and, for parking lot lighting, verification that the fixtures are classified by the IESNA as "full cutoff" (FCO); OR provide documentation that exterior luminaires are IDA-Approved as Dark-Sky Friendly by the International Dark Sky Association (IDA) Fixture Seal of Approval Program.
4. Irrigation Systems: Provide manufacturer's cut sheets for all permanent landscape irrigation system components and for any rainwater harvesting system components, such as cisterns.
5. Water Conserving Fixtures: Submittals must include manufacturer's cut sheets for all water-consuming plumbing fixtures and fittings (toilets, urinals, faucets, showerheads, etc.) highlighting maximum flow rates and/or flush rates. Include cut sheets for any automatic faucet-control devices.
6. Process Water Use: Provide manufacturer's cut sheets for all water-consuming commercial equipment (clothes washers, dishwashers, ice machines, etc.), highlighting water consumption performance. Include manufacturer's cut sheets or product data for any cooling towers, highlighting water consumption estimates, water use reduction measures, and corrosion inhibitors.
7. Elimination of CFCs AND HCFCs: Provide manufacturer's cut sheets for all cooling equipment with manufacturer's product data, highlighting refrigerants; provide manufacturer's cut sheets for all fire-suppression equipment, highlighting fire-suppression agents; provide manufacturer's cut-sheets for all polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation, highlighting the blowing agent(s).
8. Appliances and Equipment: Provide copies of manufacturer's product data for all Energy Star eligible equipment and appliances,

- including office equipment, computers and printers, electronics, and commercial food service equipment (excluding HVAC and lighting components), verifying compliance with EPA's Energy Star program.
9. On-Site Renewable Energy Systems: Provide cut sheets and manufacturer's product data for all on-site renewable energy generating components and equipment, including documentation of output capacity.
 10. Measurement and Verification Systems: Provide cut sheets and manufacturer's product data for all controls systems, highlighting electrical metering and trending capability components.
 11. Salvaged or Reused Materials: Provide documentation that lists each salvaged or reused material, the source or vendor of the material, the purchase price, and the replacement cost if greater than the purchase price.
 12. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation: Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product
 - a. An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. This spreadsheet shall be submitted every third month with the Contractor's Certificate and Application for Payment. It should indicate, on an ongoing basis, line items for each material, including cost, pre-consumer recycled content, post-consumer recycled content, and combined recycled content value.
 13. Regional Materials: Submittals for all products or materials expected to contribute to the regional calculation (excluding MEP systems equipment and components) must include the following documentation:
 - a. Cost of each material or product, excluding cost of labor and equipment for installation

- b. Location of product manufacture and distance from point of manufacture to the Project Site
 - c. Location of point of extraction, harvest, or recovery for each raw material in each product and distance from the point of extraction, harvest, or recovery to the Project Site
 - d. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of manufacture for each regional material
 - e. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of extraction, harvest, or recovery for each regional material or product, including, at a minimum, gravel and fill, planting materials, concrete, masonry, and GWB
 - f. An electronic spreadsheet that tabulates the Project's total materials cost and regional materials value, expressed as a percentage of total materials cost. This spreadsheet shall be submitted every third month with the Contractor's Certificate and Application for Payment. It should indicate on an ongoing basis, line items for each material, including cost, location of manufacture, distance from manufacturing plant to the Project Site, location of raw material extraction, and distance from extraction point to the Project Site.
14. Outdoor Air Delivery Monitoring: Provide manufacturer's cut sheets highlighting the installed carbon dioxide monitoring system components and sequence of controls shop drawing documentation, including CO2 differential set-points and alarm capabilities.
15. Interior Adhesives and Sealants: Submittals for all field-applied adhesives and sealants, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
- a. Provide manufacturers' documentation verifying all adhesives used to apply laminates, whether shop-applied or field-applied, contain no urea-formaldehyde.
16. Interior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on indoor air,

- must include manufacturer's MSDSs or other Product Data highlighting VOC content
17. Exterior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on ambient air quality, must include manufacturer's MSDSs or other manufacturer's Product Data highlighting VOC content.
 19. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard, wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer's product data verifying that these products contain no urea-formaldehyde resins.
 20. Systems Furniture and Seating: Provide manufacturer's product data verifying that all systems furniture and seating products meet the requirements of one of the following:
 - a. Greenguard certification
 - b. SCS Indoor Advantage certification
 - c. SCS Indoor Advantage Gold certification
 - d. BIFMA Standard X7.1-2005, as tested to BIFMA method M7.1-2005 and as verified by an independent laboratory
 - d. Calculated indoor air concentration limits for furniture systems and seating determined by the U.S. EPA's Environmental Technology Verification Large Chamber Test Protocol for Measuring Emissions of VOCs and Aldehydes (September 1999) testing protocol as conducted in an independent air quality testing laboratory
 21. Entryway Systems: Provide manufacturer's cut sheets for all walk-off systems installed to capture particulates, including permanently installed grates, grilles, slotted systems, direct glue-down walk-off mats, and non-permanent roll-out mats.
 22. Air Filtration: Provide manufacturer's cut sheets and product data highlighting the following:
 - a. Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs) per ASHRAE HVAC Design Manual for Hospitals and Clinics.
 - b. Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if

permanently installed AHUs are used during construction. See above for requirements

23. Mercury in Lighting: Provide manufacturer's cut sheets or product data for all fluorescent or HID lamps highlighting mercury content.
24. Lighting Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all lighting controls systems components.
25. Thermal Comfort Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all thermal comfort-control systems components.
26. Blended Cement: It is the intent of this specification to reduce CO₂ emissions and other environmentally detrimental effects resulting from the production of portland cement by requiring that all concrete mixes, in aggregate, utilize blended cement mixes to displace portland cement as specified in Section 03 30 00, CONCRETE typically included in conventional construction. Provide the following submittals:
 - a. Copies of concrete design mixes for all installed concrete
 - b. Copies of typical regional baseline concrete design mixes for all compressive strengths used on the Project
 - c. Quantities in cubic yards of each installed concrete mix
27. Gypsum Wall Board: Provide manufacturer's cut sheets or product data verifying that all gypsum wallboard products are moisture and mold-resistant.
28. Fiberglass Insulation: Provide manufacturer's cut sheets or product data verifying that fiberglass batt insulation contains no urea-formaldehyde.
29. Duct Acoustical Insulation: Provide manufacturer's cut sheets or product data verifying that mechanical sound insulation materials in air distribution ducts consists of an impervious, non-porous coatings that prevent dust from accumulating in the insulating materials.
30. Green Housekeeping: Provide documentation that all cleaning products and janitorial paper products meet the VOC limits and content requirements of this specification section.

B. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:

1. Not more than 60 days after the Preconstruction Meeting, the General Contractor shall provide to the Owner and Architect a preliminary schedule of materials costs for all materials used for the Project organized by specification section. Exclude labor costs and all mechanical, electrical, and plumbing (MEP) systems materials and labor costs. Include the following:
 - a. Identify each reused or salvaged material, its cost, and its replacement value.
 - b. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.
 - c. Identify each regional material, its cost, its manufacturing location, the distance of this location from the Project site, the source location for each raw material component of the material, the distance of these extraction locations from the Project site, and the total value of regional materials as a percentage of total materials costs.
 - d. Identify each biobased material, its source, its cost, and the total value of biobased materials as a percentage of total materials costs. Also provide the total value of rapidly renewable materials (materials made from plants that are harvested in less than a 10-year cycle) as a percentage of total materials costs.
 - e. Identify each wood-based material, its cost, the total wood-based materials cost, each FSC Certified wood material, its cost, and the total value of Certified wood as a percentage of total wood-based materials costs.
2. Provide final versions of the above spreadsheets to the Owner and Architect not more than 14 days after Substantial Completion.

- C. Construction Waste Management: See Section 01 74 19 "Construction Waste Management" for submittal requirements.
- D. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:
1. Not more than 30 days after the Preconstruction Meeting, prepare and submit for the Architect and Owner's approval, an electronic copy of the draft Construction IAQ Management Plan in an electronic file including, but not limited to, descriptions of the following:
 2. Instruction procedures for meeting or exceeding the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling
 - a. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage
 - b. Schedule of submission to Architect of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials
 - c. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille
 - d. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit
 3. Not more than 30 days following receipt of the approved draft CIAQMP, submit an electronic copy of the approved CIAQMP in an electronic file, along with the following:
 - a. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for all filtration media to be installed at return air grilles during construction if permanently installed AHUs are used during construction.
 - b. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs).

4. Not more than 14 days after Substantial Completion provide the following:
 - a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, required installation of filtration during construction.
 - b. Minimum of 18 Construction photographs: Six photographs taken on three different occasions during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
- E. Commissioning: See Section 01 91 00 "General Commissioning Requirements" for submittal requirements.
- F. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports for the following:
 1. Construction Waste Management: Waste reduction progress reports and logs complying with the requirements of Section 01 74 19 "Construction Waste Management."
 2. Construction IAQ Management: See details below under Section 3.2 Construction Indoor Air Quality Management for Construction IAQ management progress report requirements.

1.6 QUALITY ASSURANCE

- A. Preconstruction Meeting: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner, Architect, and all Subcontractors to discuss the Construction Waste Management Plan, the required Construction Indoor Air Quality (IAQ) Management Plan, and all other Sustainable Design Requirements. The purpose of this meeting is to develop a mutual understanding of the Project's Sustainable Design Requirements and coordination of the Contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.
- B. Construction Job Conferences: The status of compliance with the Sustainable Design Requirements of these specifications will be an agenda item at all regular job meetings conducted during the course of work at the site.

PART 2 - PRODUCTS

2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS

- A. Site Clearing: Topsoil shall be provided by the Contractor from on-site material which has been stockpiled for reuse. Off-site borrow should only be used when on-site sources are exhausted. Chip and/or compost on site all vegetated material identified for removal.
- B. Do not burn rubbish, organic matter, etc. or any material on the site. Dispose of legally in accordance with Specifications Sections 01 74 19.
- C. Roofing Materials: All roofing systems, other than vegetated roof systems, must comply with the following requirements:
 - 1. Low-Sloped roofing less than or equal to 2:12 slope must have an SRI of at least 78.
 - 2. Steep-Sloped roofing greater than 2:12 slope must have an SRI of at least 29.
 - 3. Roofing Materials: Light-colored, reflective, and high-emissivity roofing helps to reduce localized heat build-up from roof surfaces that contribute to the urban heat island effect.
- D. Exterior Lighting Fixtures:
 - 1. All exterior luminaires must emit 0% of the total initial designed fixture lumens at an angle above 90° from nadir and/or meet the requirements of the Dark Sky certification program.
 - 2. Exterior lighting cannot exceed 80% of the lighting power densities defined by ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments.
 - 3. No lighting of building facades or landscape features is permitted.
- E. Herbicides and Pest Control: Herbicides shall not be permitted, and pest control measures shall utilize EPA-registered biopesticides only.
- F. Landscape Irrigation: Use water-efficient landscape and irrigation strategies, including water reuse and recycling, to reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means (plant species and plant densities).
- G. Water-Conserving Fixtures: Plumbing fixtures and fittings shall use in aggregate at least 20% less water than the water use baseline calculated for the building after meeting the Energy Policy Act of 1992 fixture performance requirements. Flow and flush rates shall not exceed the following:

1. Toilets: no more than 1.3 gallons per flush, otherwise be dual flush 1.6/0.8 gallons per flush, and have documented bowl evacuation capability per MaP testing of at least 400 grams
 2. Urinals: Waterless or Water sense rated with no more than 0.5 gallons per flush.
 3. Lavatory Faucets: 0.5 gpm with automatic faucet controls
 4. Kitchen Sink Lavatories: 2.2 gpm
 5. Showerheads: no more than 1.5gpm
- H. Process Water Use: Employ strategies that in aggregate result in 20% less water use than the process water use baseline for the building after meeting the commercial equipment and HVAC performance requirements as listed in the Table below. For equipment not addressed by EPACT 2005 or the list below, additional equipment performance requirements may be proposed provided documentation supporting the proposed benchmark or industry standard is submitted.
1. Clothes Washer: 7.5 gallons/cubic foot/cycle
 2. Dishwasher with Racks: 1.0 gallons/rack
 3. Ice Machine: 20 gallons/100 pounds ice for machines making over 175 pounds of ice per day; 30 gallons/100 pounds ice for machines making less than 175 ice per day. Avoid water-cooled machines.
 4. Food Steamer: 2 gallons/hour. Use only boilerless steamers.
 5. Pre-Rinse Spray Valves: 1.4 gallons/minute
 6. Kitchen Pot-Washing Sinks: 2.2 gallons/minute
 7. Cooling Towers: 2.3 gallons/ton-hr. water loss
- I. Elimination of CFCs AND HCFCs:
1. Ozone Protection and Greenhouse Gas Reduction: Base building cooling equipment shall contain no refrigerants other than the following: HCFC-123, HFC-134a, HFC-245fa, HFC-407c, or HFC 410a.
 2. Fire suppression systems may not contain ozone-depleting substances such as halon 1301 and 1211.
 3. Extruded polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation shall not be manufactured with hydrochlorofluorocarbon (HCFC) blowing agents.
- J. Appliances and Equipment: All materials and equipment being installed that falls under the Energy Star or FEMP programs must be Energy Star or FEMP-rated. Eligible equipment includes refrigerators, motors,

laundry equipment, office equipment and more. Refer to each program's website for a complete list.

K. HVAC Distribution Efficiency:

1. All duct systems shall be constructed of aluminum, stainless steel or galvanized sheet metal, as deemed appropriate based on the application requirements. No fiberglass duct board shall be permitted.
2. All medium- and high-pressure ductwork systems shall be pressure-tested in accordance with the current SMACNA standards.
3. All ductwork shall be externally insulated. No interior duct liner shall be permitted.
4. Where possible, all air terminal connections shall be hard-connected with sheet metal ductwork. If flexible ductwork is used, no flexible duct extension shall be more than six feet in length.
5. All HVAC equipment shall be isolated from the ductwork system with flexible duct connectors to minimize the transmittance of vibration.
6. All supply and return air branch ducts shall include the appropriate style of volume damper. Air terminal devices such as grilles, registers, and diffusers shall be balanced at duct branch dampers, not at terminal face.

L. Measurement and Verification: Install controls and monitoring devices as required by MEP divisions order to comply with International Performance Measurement & Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003, Option D.

1. The IPMVP provides guidance on situation-appropriate application of measurement and verification strategies.

M. Salvaged or Reused materials: There shall be no substitutions for specified salvaged and reused materials and products.

1. Salvaged materials: Use of salvaged materials reduces impacts of disposal and manufacturing of replacements.

N. Recycled Content of Materials:

1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of 30% of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and

delivery costs. The Contractor shall make all attempts to maximize the procurement of materials with recycled content.

- a. The post-consumer recycled content value of a material shall be determined by dividing the weight of post-consumer recycled content by the total weight of the material and multiplying by the cost of the material.
- b. Do not include mechanical and electrical components in the calculations.
- c. Do not include labor and delivery costs in the calculations.
- d. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).
- e. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.
- f. The materials in the following list must contain the minimum recycled content indicated:

Category	Minimum Recycled Content
Compost/mulch	100% post-consumer
Asphaltic Concrete Paving	25% post-consumer
Cast-in-Place Concrete	6% pre-consumer
CMU: Gray Block	20% pre-consumer
Steel Reinforcing Bars	90% combined
Structural Steel Shapes	90% combined
Steel Joists	75% combined
Steel Deck	75% combined
Steel Fabrications	60% combined
Steel Studs	30% combined
Steel Roofing	30% post-consumer
Aluminum Fabrications	35% combined

Rigid Insulation	20% pre-consumer
Batt insulation	30% combined

O. Biobased Content:

1. For products designated by the USDA's BioPreferred program, provide products that meet or exceed USDA recommendations for biobased content, so long as products meet all other performance requirements in VA master specifications. For more information regarding the product categories covered by the BioPreferred program, visit <http://www.biopreferred.gov>

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SECTION 02 21 00
SITE SURVEYS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the gathering of research documents, performance of a topographic survey and preparation of a topographic survey map.

1.2 DEFINITIONS

- A. Professional Land Surveyor: One who possesses a valid state license as a "Professional Land Surveyor" from the state in which they practice.
- B. Professional Civil Engineer: One who possesses a valid state license as a "Professional Civil Engineer" from the state in which they practice. For this section, the term "surveyor" shall also include Professional Civil Engineers authorized to practice Land Surveying under the laws of the state in which they practice.

PART 2 - EXECUTION

- A. The surveyor shall research available public records for all mapping, monumentation, plats, governmental surveys etc. that may pertain to the subject property. Research all applicable public utilities for substructure data such as sewers, storm drains, water lines, electrical conduits etc.
- B. The survey shall be performed on the ground in accordance with the current "Accuracy Standards for Land Title Surveys" as adopted, from time to time, by the American Congress on Surveying and Mapping, the National Society of Professional Surveyors, and the American Land Title Association.
- C. The surveyor, when applicable, shall consult with the project Architect to determine scale of plat or map and size of drawings.
- D. The surveyor shall furnish two sets of prints of the plat or map of survey and an electronic CADD file. If the plat or map of survey consists of more than one sheet, the sheets shall be numbered, the total number of sheets indicated and the match lines be shown on each sheet.
- E. On the plat or map, the survey boundary shall be drawn to a convenient scale, or the scale designated by the Architect, with the scale clearly indicated. A graphic scale, shown in feet or meters or both, shall be included. A north arrow shall be shown and when practicable, the plat or map of survey shall be oriented so that north is at the top of the drawing. Symbols or abbreviations used shall be identified on the face of the plat or map by use of a legend or other means. Supplementary or

exaggerated diagrams shall be presented accurately on the plat or map where dimensional data is too small to be shown clearly at full scale. The plat or map shall be 30 by 42 inches.

F. The survey shall contain the following applicable information:

1. The name, address, telephone number, and signature of the Professional Land Surveyor who made the survey, his or her official seal and registration number, the date the survey was completed and the dates of all revisions.
2. The survey drawing(s) submitted shall bear the following certification adjacent to the Engineer's official seal:
"I hereby certify that all information indicated on this drawing was obtained or verified by actual measurements in the field and that every effort has been made to furnish complete and accurate information."
3. Vicinity map showing the property surveyed in reference to nearby highways or major street intersections.
4. Flood zone designation (with proper annotation based on Federal Flood Insurance Rate Maps or the state or local equivalent, by scaled map location and graphic plotting only).
5. Land area as defined by the boundaries of the legal description of the surveyed premises.
6. All data necessary to indicate the mathematical dimensions and relationships of the boundary represented by bearings and distances, and the length and radius of each curve, together with elements necessary to mathematically define each curve. The point of beginning of the surveyor's description and the basis of bearings shall also be shown.
7. When record bearings or angles or distances differ from measured bearings, angles or distances, both record and measured bearings, angles, and distances shall be clearly indicated. If the record description fails to form a mathematically closed figure, the surveyor shall so indicate.
8. Measured and record distances from corners of parcels surveyed to the nearest right-of-way lines of streets in urban or suburban areas, together with recovered lot corners and evidence of lot corners, shall be noted. The distances to the nearest intersecting street shall be indicated and verified. Names and widths of streets and highways abutting the property surveyed and widths of rights of way shall be given. Observable evidence of access (or lack thereof) to

- such abutting streets or highways shall be indicated. Observable evidence of private roads shall be so indicated. Streets abutting the premises, which have been described in Record Documents, but not physically opened, shall be shown and so noted.
9. The identifying titles of all recorded plats, filed maps, right of way maps, or similar documents which the survey represents, wholly or in part, with their appropriate recording data. The survey shall indicate platted setback or building restriction lines which have been recorded in subdivision plats or which appear in a Record Document which has been delivered to the surveyor. Contiguity, gores, and overlaps along the exterior boundaries of the survey premises, where ascertainable from field evidence or Record Documents, or interior to those exterior boundaries, shall be clearly indicated or noted. Where only a part of a recorded lot or parcel is included in the survey, the balance of the lot or parcel shall be indicated.
 10. All evidence of found monuments shall be shown and noted. All evidence of monuments found beyond the surveyed premises on which establishment of the corners of the survey premises are dependent, and their application related to the survey shall be indicated.
 11. The character of any and all evidence of possession shall be stated and the location of such evidence carefully given in relation to both the measured boundary lines and those established by the record. An absence of notation on the survey shall be presumptive of no observable evidence of possession. The term "possession" does not imply "ownership".
 12. The location of all buildings upon the plot or parcel shall be shown and their locations defined by measurements perpendicular to the boundaries. If there are no buildings, so state. Proper street numbers shall be shown where available.
 13. All easements evidenced by a Record Document which have been delivered to the surveyor shall be shown, both those burdening and those benefiting the property surveyed, indicating recording information. If such an easement cannot be located, a note to this affect shall be included. Observable evidence of easements and/or servitudes of all kinds, such as those created by roads, rights-of-ways, water courses, drains, telephone, telegraph, or electric lines, water, sewer, oil or gas pipelines on or across the surveyed property and on adjoining properties if they appear to affect the surveyed

- property, shall be located and noted. Surface indications, if any, or of underground easements and/or servitudes shall also be shown.
14. The character and location of all walls, buildings, fences, and other visible improvements within five feet of each side of the boundary lines shall be noted. Without expressing a legal opinion, physical evidence of all encroaching structural appurtenances and projections, such as fire escapes, bay windows, windows and doors that open out, flue pipes, stoops, eaves, cornices, areaways, stoops, trip, etc., by or on adjoining property or on abutting streets, on any easement or over setback lines shown by Record Documents shall be indicated with the extent of such encroachment or projection.
 15. Driveways and alleys on or crossing the property must be shown. Where there is evidence of use by other than the occupants of the property, the surveyor must so indicate on the plat or map. Where driveways or alleys on adjoining properties encroach, in whole or in part, on the property being surveyed, the surveyor must so indicate on the plat or map with appropriate measurements.
 16. Location, alignment and dimensions of all roads, curbs, walks, parking and paved areas abutting the subject land. Indicate road centerlines with true bearings and lengths by 50 foot stationing. Describe curves by designating the points of curvature and tangency by station. Include all curve data as well a location of radius and vertex points. Elevations on 50' centers on centerline of roads, edges of roads and top and bottom of curbs.
 17. As accurately as the evidence permits, the location of cemeteries and burial grounds disclosed in the process of researching title to the premises or observed in the process of performing the field work for the survey, shall be shown.
 18. Ponds, lakes, springs, or rivers bordering on or running through the premises being surveyed shall be shown. When a property surveyed contains a natural water boundary, the surveyor shall measure the location of the boundary according to appropriate surveying methods and note on the plat or map the date of the measurement and the caveat that the boundary is subject to change due to natural causes and that it may or may not represent the actual location of the limit of title. When the surveyor is aware of changes in such boundaries, the extent of those changes shall be identified.

19. Contours at a minimum interval of 1 foot. Base vertical control on the permanent (not assumed) National Geodetic Survey (NGS) or VA Medical Center Bench Mark. Note location, description and datum.
20. Identify and show if possible, setback, height, and floor space area restrictions of record or disclosed by applicable zoning or building codes (in addition to those recorded in subdivision maps). If none, so state.
21. Exterior dimensions of all buildings at ground level. Show square footage of exterior footprint of all buildings at ground level and gross floor area of all buildings.
22. Measured height of all buildings above grade at a defined location. If no defined location is provided, the point of measurement shall be shown.
23. Elevations at each entrance to buildings, service docks, building corners, steps, ramps and grade slabs.
24. Substantial, visible improvements (in addition to buildings) such as signs, parking areas, swimming pools, etc.
25. Parking areas and, if striped, the striping and the type (eg. handicapped, motorcycle, regular, etc.) and number of parking spaces.
26. Indication of access to a public way such as curb cuts and driveways.
27. Location of utilities existing on or serving the surveyed property as determined by observed evidence together with plans and markings provided by utility companies, and other appropriate sources (with references as to the source of information. Locate and show all fire hydrants located within 500 feet of the subject property.
28. Railroad tracks and sidings.
29. Manholes, catch basins, valve vaults or other surface indications of subterranean uses.
30. Wires and cables (including their function) crossing the survey premises, all poles on or within ten feet of the surveyed premises, and the dimensions of all cross-wires or overhangs affecting the surveyed premises.
31. Utility company installations on the surveyed premises.
32. Names of adjoining owners of platted lands.
33. Observable evidence of earth moving work, building construction or building additions within recent months.
34. Any changes in street right-of-way lines either completed or proposed, and available from the controlling jurisdiction. Observable evidence of recent street or sidewalk construction or repairs.

35. Observable evidence of site use as a solid waste dump, sump or sanitary landfill.
36. All trees with a minimum diameter of 6" measured at 48" above the base of the tree. Perimeter outline only of thickly wooded areas with description of predominant vegetation.

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SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00, EARTH MOVING.
- B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.

1.3 PROTECTION:

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

- E. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
1. No wall or part of wall shall be permitted to fall outwardly from structures.
 2. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
 3. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- F. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the COR. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have COR's approval.
- G. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.4 UTILITY SERVICES:

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION:

- A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
 1. As required for installation of new utility service lines.
 2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.

- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- C. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.
- D. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COR. When Utility lines are encountered that are not indicated on the drawings, the COR shall be notified prior to further work in that area.

3.2 CLEAN-UP:

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

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:

- A. Testing agency for the trial concrete mix design retained and reimbursed by the Contractor and approved by COR. For all other testing, refer to Section 01 45 29 Testing Laboratory Services.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology. Accompany request for approval of testing agency with a copy of Report of Latest Inspection of Laboratory Facilities by CCRL.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 TOLERANCES:

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.
- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).
- D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:

1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

1.5 REGULATORY REQUIREMENTS:

- A. ACI SP-66 - ACI Detailing Manual.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 301 - Standard Specifications for Structural Concrete.

1.6 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Mill Test Reports:
 1. Reinforcing Steel.
 2. Cement.
- D. Manufacturer's Certificates:
 1. Abrasive aggregate.
 2. Air-entraining admixture.
 3. Chemical admixtures, including chloride ion content.
 4. Waterproof paper for curing concrete.
 5. Liquid membrane-forming compounds for curing concrete.
 6. Non-shrinking grout.
 7. Liquid hardener.
 8. Waterstops.
 9. Expansion joint filler.
 10. Adhesive binder.
- E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology and copy of report of latest CCRL, Inspection of Laboratory.
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement fly ash ratio curves, concrete mix ingredients, and admixtures.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement in separate suitable bins.
- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

1.8 PRE-CONCRETE CONFERENCE:

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
 - 1. Submittals.
 - 2. Coordination of work.
 - 3. Availability of material.
 - 4. Concrete mix design including admixtures.
 - 5. Methods of placing, finishing, and curing.
 - 6. Finish criteria required to obtain required flatness and levelness.
 - 7. Timing of floor finish measurements.
 - 8. Material inspection and testing.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; admixture manufacturers; COR; Consulting Engineer; Contractor retained testing laboratories for concrete testing and finish (F-number) verification.
- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

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 Concrete Institute (ACI):

- 117-10.....Specifications for Tolerances for Concrete
Construction and Materials and Commentary
- 211.1-91(R2009).....Standard Practice for Selecting Proportions for
Normal, Heavyweight, and Mass Concrete
- 211.2-98(R2004).....Standard Practice for Selecting Proportions for
Structural Lightweight Concrete
- 214R-11.....Guide to Evaluation of Strength Test Results of
Concrete
- 301-10.....Standard Practice for Structural Concrete
- 304R-00(R2009).....Guide for Measuring, Mixing, Transporting, and
Placing Concrete
- 305.1-06.....Specification for Hot Weather Concreting
- 306.1-90(R2002).....Standard Specification for Cold Weather
Concreting
- 308.1-11.....Specification for Curing Concrete
- 309R-05.....Guide for Consolidation of Concrete
- 318-11.....Building Code Requirements for Structural
Concrete and Commentary
- 347-04.....Guide to Formwork for Concrete
- SP-66-04.....ACI Detailing Manual
- C. American National Standards Institute and American Hardboard Association
(ANSI/AHA):
 - A135.4-2004.....Basic Hardboard
- D. American Society for Testing and Materials (ASTM):
 - A82/A82M-07.....Standard Specification for Steel Wire, Plain,
for Concrete Reinforcement
 - A185/185M-07.....Standard Specification for Steel Welded Wire
Reinforcement, Plain, for Concrete
 - A615/A615M-09.....Standard Specification for Deformed and Plain
Carbon Steel Bars for Concrete Reinforcement
 - A653/A653M-11.....Standard Specification for Steel Sheet, Zinc
Coated (Galvanized) or Zinc Iron Alloy Coated
(Galvannealed) by the Hot Dip Process
 - A706/A706M-09.....Standard Specification for Low Alloy Steel
Deformed and Plain Bars for Concrete
Reinforcement

A767/A767M-09.....Standard Specification for Zinc Coated
(Galvanized) Steel Bars for Concrete
Reinforcement

A775/A775M-07.....Standard Specification for Epoxy Coated
Reinforcing Steel Bars

A820-11.....Standard Specification for Steel Fibers for
Fiber Reinforced Concrete

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

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

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

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

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

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

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

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

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

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

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

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

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

C309-11.....Standard Specification for Liquid Membrane
Forming Compounds for Curing Concrete

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

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

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

C666/C666M-03(R2008).....Standard Test Method for Resistance of Concrete
to Rapid Freezing and Thawing
C881/C881M-10.....Standard Specification for Epoxy Resin Base
Bonding Systems for Concrete
C1107/1107M-11.....Standard Specification for Packaged Dry,
Hydraulic-Cement Grout (Non-shrink)
C1315-11.....Standard Specification for Liquid Membrane
Forming Compounds Having Special Properties for
Curing and Sealing Concrete
D6-95(R2011).....Standard Test Method for Loss on Heating of Oil
and Asphaltic Compounds
D297-93(R2006).....Standard Methods for Rubber Products Chemical
Analysis
D412-06AE2.....Standard Test Methods for Vulcanized Rubber and
Thermoplastic Elastomers - Tension
D1751-04(R2008).....Standard Specification for Preformed Expansion
Joint Filler for Concrete Paving and Structural
Construction (Non-extruding and Resilient
Bituminous Types)
D4263-83(2012).....Standard Test Method for Indicating Moisture in
Concrete by the Plastic Sheet Method.
D4397-10.....Standard Specification for Polyethylene Sheeting
for Construction, Industrial and Agricultural
Applications
E1155-96(R2008).....Standard Test Method for Determining F_F Floor
Flatness and F_L Floor Levelness Numbers
F1869-11.....Standard Test Method for Measuring Moisture
Vapor Emission Rate of Concrete Subfloor Using
Anhydrous Calcium Chloride.

E. American Welding Society (AWS):

D1.4/D1.4M-11.....Structural Welding Code - Reinforcing Steel

F. Concrete Reinforcing Steel Institute (CRSI):

Handbook 2008

G. National Cooperative Highway Research Program (NCHRP):

Report On.....Concrete Sealers for the Protection of Bridge
Structures

H. U.S. Department of Commerce Product Standard (PS):

PS 1.....Construction and Industrial Plywood

PS 20.....American Softwood Lumber

I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:

CRD C513.....Rubber Waterstops

CRD C572.....Polyvinyl Chloride Waterstops

PART 2 - PRODUCTS:

2.1 FORMS:

- A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.
- D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- E. Corrugated Fiberboard Void Boxes: Double faced, completely impregnated with paraffin and laminated with moisture resistant adhesive, size as shown. Design forms to support not less than 48 KPa (1000 psf) and not lose more than 15 percent of their original strength after being completely submerged in water for 24 hours and then air dried.
- F. Form Lining:
 - 1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
 - 2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
 - 3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.
- G. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

2.2 MATERIALS:

- A. Portland Cement: ASTM C150 Type I or II.

- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33.
 - 1. Size 67 or Size 467 shall be used for footings and walls over 300 mm (12 inches) thick.
 - 2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
 - 3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- D. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 μ m (No. 100) sieve.
- E. Mixing Water: Fresh, clean, and potable.
- F. Admixtures:
 - 1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
 - 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
 - 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
 - 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer shall have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
 - 5. Air Entraining Admixture: ASTM C260.
 - 6. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
 - 7. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.

- G. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- H. Welded Wire Fabric: ASTM A185.
- I. Reinforcing Bars to be Welded: ASTM A706.
- J. Galvanized Reinforcing Bars: ASTM A767.
- K. Epoxy Coated Reinforcing Bars: ASTM A775.
- L. Cold Drawn Steel Wire: ASTM A82.
- M. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m² (1.5 pounds per square yard), or square mesh at .6Kg/m² (1.17 pounds per square yard).
- N. Supports, Spacers, and Chairs: Types which shall hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- O. Expansion Joint Filler: ASTM D1751.
- P. Sheet Materials for Curing Concrete: ASTM C171.
- Q. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye, and shall meet the requirements of ASTM C1315. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- R. Abrasive Aggregate: Aluminum oxide grains or emery grits.
- S. Penetrating Sealer: For use on parking garage ramps and decks. High penetration silane sealer providing minimum 95 percent screening per National Cooperative Highway Research Program (NCHRP) No. 244 standards for chloride ion penetration resistance. Requires moist (non-membrane) curing of slab.
- T. Non-Shrink Grout:
1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
 2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

U. Adhesive Binder: ASTM C881.

V. Waterstops:

1. Polyvinyl Chloride Waterstop: CRD C572.
2. Rubber Waterstops: CRD C513.
3. Bentonite Waterstop: Flexible strip of bentonite 25 mm x 20 mm (1 inch by 3/4 inch), weighing 8.7 kg/m (5.85 lbs. per foot) composed of Butyl Rubber Hydrocarbon (ASTM D297), Bentonite (SS-S-210-A) and Volatile Matter (ASTM D6).
4. Non-Metallic Hydrophilic: Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in in 70 deg water shall be 3 to 1 minimum.

W. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).

X. Fibers:

1. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m³ (1.5 lb. per cubic yard). Product shall have a UL rating.

Y. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.

Z. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.

AA. Architectural Concrete: For areas designated as architectural concrete on the Contract Documents, use colored cements and specially selected aggregates as necessary to produce a concrete of a color and finish which exactly matches the designated sample panel.

2.3 CONCRETE MIXES:

A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.

1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement,

- fly ash, admixtures, weight of fine and coarse aggregate per m³ (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement -fly ash ratio, and consistency of each cylinder in terms of slump.
3. Prepare a curve showing relationship between water-cement -fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
 4. If the field experience method is used, submit complete standard deviation analysis.
- B. Fly Ash Testing: Submit certificate verifying conformance with ASTM 618 initially with mix design and for each truck load of fly ash delivered from source. Submit test results performed within 6 months of submittal date. Notify COR immediately when change in source is anticipated.
1. Testing Laboratory used for fly ash certification/testing shall participate in the Cement and Concrete Reference Laboratory (CCRL) program. Submit most recent CCRL inspection report.
- C. After approval of mixes no substitution in material or change in proportions of approval mixes shall be made without additional tests and approval of COR or as specified. Making and testing of preliminary test cylinders shall be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. COR shall allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.
- D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with 20% replacement by weight in all structural work. Increase this replacement to 40% for mass concrete, and reduce it to 10% for drilled piers and caissons. Fly ash shall not be used in high-early mix design.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete Strength		Non-Air- Entrained	Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio
35 (5000) ^{1,3}	375 (630)	0.45	385 (650)	0.40
30 (4000) ^{1,3}	325 (550)	0.55	340 (570)	0.50
25 (3000) ^{1,3}	280 (470)	0.65	290 (490)	0.55
25 (3000) ^{1,2}	300 (500)	*	310 (520)	*

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
 2. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
 3. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.
- E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II - MAXIMUM SLUMP, MM (INCHES)*

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Reinforced Footings and Substructure Walls	75mm (3 inches)	75 mm (3 inches)
Slabs, Beams, Reinforced Walls, and Building Columns	100 mm (4 inches)	100 mm (4 inches)

- F. Slump shall be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture shall have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches), and 75

mm to 100 mm (3 inches to 4 inches) for lightweight concrete. This shall be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

- G. 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

- H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.
- I. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required shall be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required shall be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- J. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. For air content requirements see Table III or Table IV.

- K. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests shall be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, COR shall require any one or any combination of the following corrective actions, at no additional cost to the Government:
1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
 2. Require additional curing and protection.
 3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, COR shall direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
 4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, COR shall order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
 5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the COR.

2.4 BATCHING AND MIXING:

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment shall be approved by COR. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38⁰C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
-1. degrees to 4.4 degrees C (30 degrees to 40 degrees F)	15.6 degrees C (60 degrees F.)
-17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.)	21 degrees C (70 degrees F.)

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the COR for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services shall be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise COR.

PART 3 - EXECUTION

3.1 FORMWORK:

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
 1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and COR approves their reuse.
 2. Provide forms for concrete footings unless COR determines forms are not necessary.
 3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
 1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
 3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind

of lumber used nor to develop deflection greater than $1/270$ of free span of member.

- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing shall coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails shall be 3d blued shingle or similar nails with thin flatheads.
- F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.
- G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.
 - 1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
 - 2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.
- H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.

1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
3. Do not install sleeves in beams, joists or columns except where shown or permitted by COR. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the COR, and require no structural changes, at no additional cost to the Government.
4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

I. Construction Tolerances:

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

3.2 PLACING REINFORCEMENT:

- A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
 1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Use epoxy-coated tie wire with epoxy-coated reinforcing. Secure reinforcing

- bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that shall be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports shall not be permitted.
2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
 3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
 2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (fy) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
 - a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
 - b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
 - c. Contractor retained testing agency shall test a minimum of three splices, for compliance, locations selected by COR.
 3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (fy) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and

- threaded sleeve. Exposed threads and swaging in the field not permitted.
- a. Initial qualification: In the presence of COR, make three test mechanical splices of each bar size proposed to be spliced. Contractor retained testing laboratory shall perform load test.
 - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Contractor retained testing laboratory shall perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by COR.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 VAPOR BARRIER:

- A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.
- 1. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
 - 2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
 - 3. Patch punctures and tears.

3.4 SLABS RECEIVING RESILIENT COVERING

- A. Slab shall be allowed to cure for 6 weeks minimum prior to placing resilient covering. After curing, slab shall be tested by the Contractor for moisture in accordance with ASTM D4263 or ASTM F1869. Moisture content shall be less than 3 pounds per 1000 sf prior to placing covering.
- B. In lieu of curing for 6 weeks, Contractor has the option, at his own cost, to utilize the Moisture Vapor Emissions & Alkalinity Control Sealer as follows:
- 1. Sealer is applied on the day of the concrete pour or as soon as harsh weather permits, prior to any other chemical treatments for concrete slabs either on grade, below grade or above grade receiving resilient

flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, epoxy coatings and overlays.

2. Manufacturer's representative shall be on the site the day of concrete pour to install or train its application and document. He shall return on every application thereafter to verify that proper procedures are followed.
 - a. Apply Sealer to concrete slabs as soon as final finishing operations are complete and the concrete has hardened sufficiently to sustain floor traffic without damage.
 - b. Spray apply Sealer at the rate of 20 m² (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
 - c. If within two (2) hours after initial application areas are subjected to heavy rainfall and puddling occurs, reapply Sealer product to these areas as soon as weather condition permits.

3.5 CONSTRUCTION JOINTS:

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by COR.
- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.
- C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.
- D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.

3.6 EXPANSION JOINTS AND CONTRACTION JOINTS:

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.
- B. Provide contraction (control) joints in floor slabs as indicated on the contract drawings. Joints shall be either formed or saw cut, to the

indicated depth after the surface has been finished. Complete saw joints within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

3.7 PLACING CONCRETE:

A. Preparation:

1. Remove hardened concrete, wood chips, shavings and other debris from forms.
2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
3. Have forms and reinforcement inspected and approved by COR before depositing concrete.
4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.

B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.

1. Preparing surface for applied topping:

- a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
- b. Broom clean and keep base slab wet for at least four hours before topping is applied.
- c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which shall prevent segregation. Method of conveying concrete is subject to approval of COR.

D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD hours.

2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.

3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) WEATHER.
 1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
 2. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
 3. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints shall be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
 4. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts shall be a continuation of this concrete or concrete with a conventional slump.
 5. Concrete on metal deck:
 - a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.
 - 1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.
- E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of

reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.

1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.8 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.

3.9 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, thiocyanates 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.

3.10 PROTECTION AND CURING:

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods shall be used if approved by COR.
 1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m²/L (400 square feet per gallon) on steel troweled surfaces and 7.5m²/L (300 square feet

- per gallon) on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
 3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.11 REMOVAL OF FORMS:

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
 1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members shall be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
 2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. For post-tensioned systems supporting forms and shoring not removed until stressing is completed. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

3.12 CONCRETE SURFACE PREPARATION:

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland

cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches) surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.

- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

3.13 CONCRETE FINISHES:

A. Vertical and Overhead Surface Finishes:

1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas shall not require additional finishing.
2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by COR, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.

3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
 - a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
 - b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 μm (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
 - c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
 - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.
4. Textured: Finish as specified. Maximum quantity of patched area 0.2 m^2 (2 square feet) in each 93 m^2 (1000 square feet) of textured surface.

B. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to COR and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds shall be used to establish initial grade during strike-off, unless COR determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated

(non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.

3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying shall be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys shall be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.

9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by COR from sample panel.
11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
 - a. Areas not specified otherwise in b. below:
 - 1) Slab on Grade:
 - a) Specified overall value F_F 25/ F_L 20
 - b) Minimum local value F_F 20/ F_L 15
 - 2) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
 - b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:
 - 1) Slab on grade:
 - a) Specified overall value FF 36/ FL 20
 - b) Minimum local value FF 24/ FL 15
 - 2) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
 - c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
 - d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries shall not cross a construction joint or expansion joint. A minimum local area shall be bounded by

construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.

12. Measurements

- a. Contractor retained testing laboratory shall take measurements as directed by COR, to verify compliance with FF, FL, and other finish requirements. Measurements shall occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics shall be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Contractor retained testing laboratory.
- b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.

13. Acceptance/ Rejection:

- a. If individual slab section measures less than either of specified minimum local F_F/F_L numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries shall be set at construction and contraction (control) joints, and not smaller than one-half bay.
- b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall F_F/F_L numbers, then whole slab shall be rejected and remedial measures shall be required.

14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by COR, until a slab finish constructed within specified tolerances is accepted.

3.14 SURFACE TREATMENTS:

- A. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps

and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8% per 1/10th m² (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

3.17 RETAINING WALLS:

- A. Use air-entrained concrete.
- B. Expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves installed and constructed as shown.
- C. Exposed surfaces finished to match adjacent concrete surfaces, new or existing.
- D. Place porous backfill as shown.

3.18 PRECAST CONCRETE ITEMS:

Precast concrete items, not specified elsewhere. Cast using 25 MPa (3000 psi) air-entrained concrete to shapes and dimensions shown. Finish to match corresponding adjacent concrete surfaces. Reinforce with steel for safe handling and erection.

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SECTION 03 41 33
PRECAST STRUCTURAL PRETENSIONED CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies precast prestressed concrete construction including design not shown, fabrication, erection, and other related items including bearing pads and anchorage.
- B. Precast prestressed concrete includes: single tees, double tees, hollow- core slabs, slabs, beams and spandrels, columns, I beams/box beams, tee/keystone joists, step units, and ribbed wall panels.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. Sealants and Caulking: Section 07 92 00, JOINT SEALANTS.
- D. Architectural Precast Concrete Panels: Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE.
- E. Repair of abraded galvanized and painted surfaces: Section 09 91 00, PAINTING.

1.3 QUALITY ASSURANCE:

- A. Manufacturer Qualifications: Precast concrete manufacturing plant shall be certified by Prestressed Concrete Institute, Plant Certification Program, prior to start of production.
- B. In lieu of above qualification, contractor shall meet and pay for following requirements:
 - 1. Retain an independent testing or consulting firm approved by COR.
 - 2. This firm shall inspect precast plant at two-week intervals during production and issue a report, certified by a registered Professional Engineer verifying that materials, methods, products and quality control meet all requirements of specifications and drawings. When report indicates to the contrary, COR shall reject any or all products produced during period of noncompliance with above requirements.
- C. Precast concrete work shall be performed by firms that have demonstrated capability, subject to approval, to produce and erect type of work specified.

- D. Precast concrete manufacturer shall have on staff or shall retain a qualified registered Professional Structural Engineer to certify precast concrete conforms in all aspects to requirements of ACI 318.
- E. Erector Qualifications: Regularly engaged for at least 3 years in erection of precast structural concrete similar to requirements of this project.
- F. Requirements of Regulatory Agencies: Local codes plus applicable specifications, standards and codes are a part of these specifications.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Erection Drawings:
 - a. Plans and/or elevations locating and defining material furnished by manufacturer.
 - b. Sections and details showing connections, cast-in items and their relation to structure.
 - c. Description of all loose, cast-in and field hardware.
 - d. Field installed anchor location drawings.
 - e. Erection sequences and handling requirements.
 - f. Dead, live and other applicable loads used in design.
 - 2. Production drawings:
 - a. Elevation view of each member.
 - b. Sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, and essential embedded hardware.
 - c. Lifting and erection inserts.
 - d. Dimensions and finishes.
 - e. Prestress for strand and concrete strengths.
 - f. Estimated cambers.
 - g. Method of transportation.
- C. Product Design Criteria:
 - 1. Loadings for design:
 - a. Initial handling and erection stresses.
 - b. Dead and live loads as specified on contract drawings.
 - c. Other loads specified for member where they are applicable.
 - d. Deflection of precast members shall be limited as follows:
 - 1) Vertical Live Load - Span/360

- 2) Wind Load - $0.0025 \times \text{Floor to Floor Height}$
- e. Design shall provide for thermal movements of completed structure.
- 2. Design calculations of products shall be performed by a registered Professional Engineer experienced in precast prestressed concrete design.
- 3. Design shall be in accordance with applicable codes, ACI 318 and the PCI Design Handbook.
- 4. Details for waterproof joints between precast members.
- D. Mix Designs: Submit proposed concrete mix designs and appropriate test data as specified in Part 2 of this section.
- E. Permissible Design Deviations:
 - 1. Design connections according to the conceptual details shown in the contract documents.
 - 2. Design deviations shall be permitted only after COR's written approval of manufacturer's proposed design supported by complete design calculations and drawings.
 - 3. Design deviations shall provide an installation equivalent to basic intent without incurring additional cost to the Government.
- F. Test Reports: Concrete and other material.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Delivery and Handling:
 - 1. Lift and support precast concrete members during manufacturing, stockpiling, transporting and erection operations only at lifting or supporting points, or both, as shown on contract and shop drawings, and with approved lifting devices. Lifting devices shall have a minimum safety factor of 4. Exterior lifting hardware shall have a minimum safety factor of 5.
 - 2. Transportation, sitehandling, and erection shall be performed with acceptable equipment and methods, and by qualified personnel.
- B. Storage:
 - 1. Store all units off ground.
 - 2. Place stored units so that identification marks are discernible.
 - 3. Separate stacked members by battens across full width of each bearing point.
 - 4. Stack so that lifting devices are accessible and undamaged.
 - 5. Do not use upper members of stacked tier as storage area for shorter member or heavy equipment.

1.6 APPLICABLE PUBLICATIONS:

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

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

A36/A36M-08.....Standard Specifications for Carbon Structural Steel

A82-07.....Standard Specifications for Steel Wire, Plain, for Concrete Reinforcement

A123/A123M-09.....Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M-09.....Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A185-07.....Standard Specifications for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement

A307-10.....Standard Specifications for Carbon Steel Bolts and Studs

A325-10.....Standard Specifications for Structural Bolts, Steel, Heat Treated

A416/A416M-10.....Standard Specifications for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

A615/A615M-09.....Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A706/A706M-09.....Standard Specifications for Low-Allow Steel Deformed and Plain Bars for Concrete Reinforcement

A767/A767M-09.....Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

A775/A775M-03(R2008)....Standard Specifications for Epoxy-Coated Reinforcing Steel Bars

C33-03.....Standard Specifications for Concrete Aggregates

C88-05.....Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

C150-07.....Standard Specifications for Portland Cement

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

- C330-05.....Standard Specifications for Lightweight
Aggregates for Structural Concrete
- C494/C494M-10.....Standard Specification for Chemical Admixtures
for Concrete
- C. American Concrete Institute (ACI):
 - 117-10.....Standard Specifications for Tolerances for
Concrete Construction and Materials
 - 318-08.....Building Code Requirements for Structural
Concrete and Commentary
- D. Prestressed Concrete Institute (PCI):
 - MNL-116-99.....Manual for Quality Control for Plants and
Production of Precast Concrete Products Fourth
Edition
 - MNL-127-99.....Erector's Manual: Standards and Guidelines for
the Erection of Precast Concrete Products
- F. American Welding Society (AWS):
 - D1.1/D1.1M-10.....Structural Welding Code - Steel
 - D1.4-11.....Structural Welding Code - Reinforcing Steel

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Portland Cement: ASTM C150, Type I or III.
- B. Aggregates: ASTM C33, Coarse and Fine.
- C. Lightweight Coarse Aggregate: ASTM C330, maximum size 19mm (3/4 inch), maximum 15 percent loss when tested in accordance with ASTM C88.
- D. Air-entraining Admixture: ASTM C260.
- E. Chemical Admixtures: ASTM C494.
- F. Mixing Water: Fresh, clean, and potable.
- G. Reinforcing Steel: ASTM A615M, Grade 400 MPa (ASTM A615, Grade 60), deformed.
- H. Weldable Reinforcing Steel: ASTM A706M, Grade 400 MPa, (ASTM A706 Grade 60).
- I. Galvanized Reinforcing Steel: ASTM A767M, Grade 400 MPa, (ASTM A767, Grade 60) Class II, hot-dipped galvanized after fabrication and bending.
- J. Epoxy-Coated Reinforcing Steel: ASTM A775M, Grade 400 MPa, (ASTM A775, Grade 60).
- K. Anchor Bolts: ASTM A307, low-carbon steel bolts, regular hexagon nuts and carbon steel washers, galvanized.

- L. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon bolts, and hardened washers complying with ASTM A325, galvanized.
- M. Welded Wire Fabric: ASTM A185.
- N. Wire Reinforcement: ASTM A82.
- O. Prestressing Steel: ASTM A416, Grade 250K or 270K, uncoated, 7-wire, stress-relieved strand.
- P. Anchors and Inserts: ASTM A36 structural steel plates and shapes, ASTM A153 or ASTM A123 hot dipped galvanized finish.
- Q. Non-metallic Shrinkage-Resistant Grout: Proprietary pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C-621. Minimum cube strength of 62 MPa (9000 psi) at 28 days when placed at flowable consistency.
- R. Bearing Pads:
 - 1. Elastomeric Pads: Vulcanized, chloroprene elastomeric compound, molded to size or cut from a molded sheet, 50-60 shore A durometer.
 - 2. Laminated Fabric-Rubber Pads: Preformed, unused synthetic fibers and new, unvulcanized rubber. Surface hardness of 70-80 shore A durometer.
 - 4. Sliding Pads: Manufactured assembly with Polytetrafluoroethylene (PTFE) surface, with glass fiber reinforcing as required for service load bearing stress. Combine with elastomeric base where required for full contact bearing.
 - 5. Plastic: Multi-monomer plastic strips, non-leaching and able to support construction loads with no visible overall expansion.
- S. Welded Studs: AWS D1.1.
- T. Welded Rebar: AWS D1.4.
- U. Caulking and Sealants: Specified under Section 07 92 00, JOINT SEALANTS.
- V. Accessories: Provide clips, hangers, and other accessories required for installation of project units and for support of subsequent construction or finishes.

2.2 CONCRETE MIXES:

- A. Normal-Weight Concrete:
 - 1. Compressive Strength: 35 MPa (5000 psi) minimum at 28 days.
 - 2. Release Strength: 25 MPa (3500 psi) minimum at transfer of prestress.
- B. Lightweight Concrete:
 - 1. Compressive Strength: 35 MPa (5000 psi) minimum at 28 days.

2. Release Strength: 25 MPa (3500 psi) minimum at transfer of prestress.
3. Air-Dry Density: Not less than 1440 kg per cubic meter (90 pounds per cubic foot) nor more than 1840 kg per cubic meter (115 pounds per cubic foot).
4. Drying Shrinkage (ASTM C330): Maximum 0.035 percent at 28 days.

C. Do not use calcium chloride, chloride ions or other salts.

2.3 FABRICATION:

- A. Fabrication Procedures: PCI MNL-116.
- B. Fabrication Tolerances: PC MNL-116 and ACI 117 for reinforcing steel placement.
- C. Finishes:
 1. Standard Underside: Resulting from casting against approved forms using good industry practice in cleaning of forms, design of concrete mix, placing and curing. Small surface holes caused by air bubbles, normal color variations, normal form joint marks, and minor chips and spalls shall be tolerated, but no major or unsightly imperfections, honeycomb, or other defects shall be permitted.
 2. Standard Top: Result of vibrating screed and additional hand finishing at projections. Normal color variations, minor indentations, minor chips and spalls shall be permitted. No major imperfections, honeycomb, or defects shall be permitted.
 3. Exposed Vertical Ends: Strands shall be recessed and the ends of member shall receive sacked finish.
- D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations. For exposed-to-view concrete surfaces, shear legs of supports are in contact with forms, provide supports with legs that are plastic protected or stainless steel protected.
- E. Use epoxy coated reinforcing whenever concrete cover is less than 50 mm (2 inches) for top surfaces exposed to deicing salts, brackish water or salt spray, such as in parking garage decks.
- F. Openings: Primarily on thin sections, factory fabricate those openings 250 mm (10 inches) round or square or larger as shown on drawings. Locate and field drill or cut other openings where no contact is made with prestressing or reinforcing steel after precast prestressed products have been erected. Opening shall be approved by COR before drilling or cutting.

- G. Patching: Patching shall be acceptable providing structural adequacy of product and appearance are not impaired.
- H. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be removed and replaced with precast concrete units that meet the requirements of this section. Contractor is also responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.
- I. Fasteners: Cast in galvanized hardware such structural inserts, bolts and plates as required by drawings.

PART 3 - EXECUTION

3.1 ERECTION:

- A. Site Access: Provide suitable access to building, proper drainage, and firm, level bearing for hauling and erection equipment to operate under their own power.
- B. Preparation:
 - 1. Provide true, level surfaces on field placed bearing walls and other field placed supporting members.
 - 2. Place and accurately align anchor bolts, plates or dowels in column footings, grade beams and other field placed support members.
 - 3. Shoring required for composite beams and slab shall have a minimum load factor of 1.5 times (dead load plus construction loads).
- C. Installation: Installation of precast prestressed concrete shall be performed by the fabricator or a competent erector in accordance with PCI MNL-127. Lift members with suitable lifting devices at points provided by manufacturer. Temporary shoring and bracing, when necessary, shall comply with manufacturer's recommendations.
- D. Alignment: Align and level precast members as required by the approved shop drawings. Level out variations between adjacent members by jacking, loading, or any other feasible method as recommended by the manufacturer and acceptable to COR. Individual pieces are considered plumb, level, and aligned if the error does not exceed 1:500 excluding structural deformation caused by loads.

3.2 FIELD WELDING:

- A. Field welding shall be done by qualified welders using equipment and materials compatible to base material in accordance with AWS D1.1 and AWS D1.4.

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- B. Field coat with galvanized paint specified under Section 09 91 00,
PAINTING all welded connections.

3.3 ATTACHMENTS:

Do not use powder-actuated or air-driven fasteners or drill the precast units for surface attachment of accessory items unless otherwise accepted by the precast manufacturer.

3.4 INSPECTION AND ACCEPTANCE:

Final inspection and acceptance of erected precast prestressed concrete shall be made by COR to verify conformance with drawings and specifications.

- - - E N D - - -

SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

This section includes the performance criteria, materials, production, and erection of architectural precast concrete cladding and load bearing units. The work performed under this section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the architectural precast concrete work shown on the contract drawings.

1.2 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. Precast pre-stressed structural building elements: Section 03 41 33, PRECAST STRUCTURAL PRETENSIONED CONCRETE.
- D. Mortar: Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING
- E. Masonry Facing: Section 04 20 00, UNIT MASONRY.
- H. Sealants and Caulking: Section 07 92 00, JOINT SEALANTS.
- I. Size, type and color of aggregate for exposed aggregate finish and matrix color: Section 09 06 00, SCHEDULE FOR FINISHES.
- K. Repair of abraded galvanized and painted surfaces: Section 09 91 00, PAINTING.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that complies with PCI MNL 117 and the following requirements and is experienced in producing units similar to those indicated for this Project and with a record of successful in-service performance:
 - 1. Assumes responsibility for engineering units to comply with performance requirements. A Comprehensive Engineering Analysis shall be performed by a qualified professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

2. Participates in PCI's Plant Certification program at the time of bidding and is designated a PCI-certified plant for Group A, Category A1- Architectural Cladding and Load Bearing Units.

3. Has sufficient production capacity to produce required units without delaying the work.

B. Erector Qualifications:

1. A precast concrete erector Qualified by the Precast/Prestressed Concrete Institute (PCI) prior to beginning work at the project site. Submit a current Certificate of Compliance furnished by PCI designating qualification in Category A (Architectural Systems) for non-load-bearing members Category S2 (Complex Structural Systems) for load-bearing members.
2. An erector with a minimum of 2 years of experience who has completed architectural precast concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance and who meets the following requirements:

- C. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117.

- D. Sample Panels: After sample approval and before fabricating units, produce a minimum of two sample panels approximately 1.5 sq. m. (16 sq. ft.) in size for review by COR. Incorporate full scale details of architectural features, finishes, textures, and transitions in the sample panels. Approved sample panel may be used for mockup and range sample.

1. Locate panels where indicated or, if not indicated, as directed by COR.
2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
3. After acceptance of repair technique, maintain one sample panel at the manufacturer's plant and one at the project site in an undisturbed condition as a standard for judging the completed work.
4. When back face of precast concrete unit is to be exposed, show samples of the workmanship, color, and texture of the backup concrete as well as the facing.
5. Demolish and remove sample panels only when directed.

- E. Range Samples: After sample panel approval and before production of units, produce a minimum of three samples, approximately 1.5 sq. m. (16 sq. ft.)

in size, representing anticipated range of color and texture on project's units. Following range sample acceptance by the COR, maintain samples at the manufacturer's plant as color and texture acceptability reference.

- F. Mockups: After sample approval but before production of units, construct full sized mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

Mockup to be representative of the finished work in all respects including glass, aluminum framing, sealants and architectural precast concrete complete with all anchors, connections, flashings, and joint fillers as accepted on the final shop drawings. Build mockups to comply with the following requirements, using materials indicated for the completed work:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by COR.
2. Notify COR in advance of dates and times when mockups will be constructed.
3. Obtain COR's approval of mockups before starting fabrication.
4. Demolish and remove mockups when directed.

- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01, GENERAL REQUIREMENTS.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide units and connections capable of withstanding: the design criteria specified on the drawings, self weights and weights of materials supported or attached, for the conditions indicated, specifically in meeting the required vehicle impact loads where panels are to be installed without cable barriers.

1. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, applicable to types of units indicated.
2. Limit deflection of precast members as follows:

Vertical live load - $\text{Span} / 360$.

Wind load - Floor to floor height times 0.0025.

3. Design for handling, transportation and erection stresses.
4. **Parking Garage Vehicular Impact Loads:** Design spandrel units acting as vehicular barrier for passenger cars to resist a single load of 26.7 kN (6,000 lbs) service load and 44.5 kN (10,000 lbs) ultimate load applied horizontally in any direction, with anchorages or attachments capable of transferring this load to the structure. For design of these units,

- assume the load to act at a height of 460 mm (18 inches) above the floor or ramp surface on an area not to exceed 0.09 sq. m. (1 sq. ft.).
- B. Design framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live load deflection, shrinkage and creep of primary building structure, and other building movements.
 - C. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 27 deg C (80 deg F). Use other values, greater or smaller, whenever justified by climatic conditions at the project site as approved by contracting officer's representative.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Retain quality control records and certificates of compliance for 5 years or period of warranty, whichever is greater.
- B. Design Mixes: For each concrete mix along with compressive strength and water-absorption tests.
- C. Shop (Erection) Drawings: Detail fabrication and installation of units.
 - 1. Indicate member locations with distinctive marks that match marks placed on the panels. Provide plans, elevations, dimensions, corner details, shapes, cross sections and relationships to adjacent materials.
 - 2. Indicate aesthetic intent including joints, reveals, and extent and location of each surface finish.
 - 3. Indicate separate face and backup mix locations, and thicknesses. Indicate locations, extent and treatment of dry joints if two-stage casting is proposed.
 - 4. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, and connections.
 - 5. Indicate locations, tolerances and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 6. Indicate sequence of erection.
 - 7. Indicate locations and details of facing materials, anchors, and joint widths.
 - 8. Design Modifications:

If design modifications are necessary to meet the performance requirements and field conditions, submit design calculations and drawings. Do not adversely affect the appearance, durability or

strength of units when modifying details or materials and maintain the general design concept.

- D. Comprehensive Engineering Analysis: Provide calculations signed and sealed by the qualified professional engineer responsible for the product design. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate design criteria and loads. Indicate the location, type, magnitude and direction of all imposed loadings from the precast system to the building structural frame.
- E. Samples: Design reference samples for initial verification of design intent, approximately 300 by 300 by 50 mm (12 by 12 by 2 inches), representative of finishes, color, and textures of exposed surfaces of units.
- F. Samples for each facing unit required, showing the full range of color and texture expected. Supply sketch of each corner or special shape with dimensions. Supply sample showing color and texture of joint treatment.
- G. Welding Certificates: Copies of certificates for welding procedure specifications (WPS) and personnel.
- H. Qualification Data for fabricator and professional engineer: List of completed projects with project names and addresses, names and addresses of Resident Engineers and owners, and other information specified.
- I. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Concrete strengths and mix designs.
- J. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
 - 1. Concrete materials.
 - 2. Reinforcing materials and prestressing tendons.
 - 3. Admixtures.
 - 4. Bearing pads.
 - 5. Structural-steel shapes and hollow structural sections.
 - 6. Insulation
 - 7. Facing units.
 - 8. Anchors.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Product handling requirements of PCI MNL 117 shall be followed at the plant and project site.

- B. Deliver all units to the project site in such quantities and at such times to assure compliance with the agreed project schedule and proper setting sequence so as to limit unloading units temporarily on the ground.
- C. Lift and support units only at designated points shown on the Shop Drawings.
- D. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

1.7 WARRANTY

- A. Warranty of precast concrete work, including anchorage, joint treatment and related components to be free from defects in materials and workmanship, including cracking and spalling.
- B. After erection, completed work will be weathertight, subject to terms of Article "Warranty of Construction" FAR clause 52.246-21.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A27/A27M-10.....Steel Castings, Carbon, for General Application
 - A36/A36M-08.....Carbon Structural Steel
 - A47/A47M-99(R2009)...Ferritic Malleable Iron Castings
 - A82-07.....Steel Wire, Plain, for Concrete Reinforcement
 - A108-07.....Steel Bar, Carbon and Alloy, Cold-Finished
 - A123/A123M-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - A153/A153M-09.....Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - A184/A184M-06.....Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
 - A185-07.....Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 - A276-10.....Stainless Steel Bars and Shapes
 - A283/A283M-03(R2007).Low and Intermediate Tensile Strength Carbon Steel Plates

A307-10.....Carbon Steel Bolts and Studs, 60 000 PSI Tensile
Strength
A325/A325M-10.....Structural Bolts, Steel, Heat Treated, 120/105 ksi
Minimum Tensile Strength
A416/A416M-10.....Steel strand, Uncoated Seven-Wire for Prestressed
Concrete
A490/A490M-10.....Structural Bolts, Alloy Steel, Heat Treated, 150
ksi Minimum Tensile Strength
A496-07.....Steel Wire, Deformed, for Concrete Reinforcement
A497-07.....Steel Welded Wire Reinforcement, Deformed, for
Concrete
A500-10.....Cold-Formed Welded and Seamless Carbon Steel
Structural Tubing in Rounds and Shapes
A563/A563M-07.....Carbon and Alloy Steel Nuts
A572/A572M-07.....High-Strength Low-Alloy Columbium-Vanadium
Structural Steel
A615/A615M-09.....Deformed and Plain Billet-Steel Bars for Concrete
Reinforcement
A666-10.....Annealed or Cold-Worked Austenitic Stainless Steel
Sheet, Strip, Plate, and Flat Bar
A675/A675M-03(R2009).Steel Bars, Carbon, Hot-Wrought, Special Quality,
Mechanical Properties
A706/A706M-09.....Low-Alloy Steel Deformed and Plain Bars for
Concrete Reinforcement
A767/A767M-09.....Zinc-Coated (Galvanized) Steel Bars for Concrete
Reinforcement
A775/A775M-07.....Epoxy-Coated Steel Reinforcing Bars
A780-09.....Repair of Damaged and Uncoated Areas of Hot-Dip
Galvanized Coatings
A884/A884M-06.....Epoxy-Coated Steel Wire and Welded Wire Fabric for
Reinforcement
A934/A934M-07.....Epoxy-Coated Prefabricated Steel Reinforcing Bars
B227-10.....Hard-Drawn Copper-Clad Steel Wire
B633-07.....Electrodeposited Coatings of Zinc on Iron and
Steel
C33-11.....Concrete Aggregates
C40-04.....Organic Impurities in Fine Aggregate for Concrete
C150-09.....Portland Cement
C260-10.....Air-Entraining Admixtures for Concrete

- C330-09.....Lightweight Aggregates for Structural Concrete
C373-88(R2006).....Test Method for Water Absorption, Bulk Density,
Apparent Porosity, and Apparent Specific Gravity
of Fired Whiteware Products
C494/C494M-10.....Chemical Admixtures for Concrete
C618-08.....Coal Fly Ash and Raw or Calcined Natural Pozzolan
for Use as a Mineral Admixture in Concrete
C881/C881M-10.....for Epoxy-Resin-Base Bonding Systems for Concrete
C979-10.....Pigments for Integrally Colored Concrete
C989-10.....Ground Granulated Blast-Furnace Slag for Use in
Concrete and Mortars
C1017/C1017M-07.....Chemical Admixtures for Use in Producing Flowing
Concrete
C1107-08.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
C1218/C1218M-99(R2008)Test Method for Water-Soluble Chloride in Mortar
and Concrete
C1240-10.....Silica Fume Used in Cementitious Mixtures
D412-06.....Test Methods for Vulcanized Rubber and
Thermoplastic Elastomers—Tension
D2240-05(R2010).....Test Method for Rubber Property—Durometer Hardness
F436/F436M-10.....Hardened Steel Washers
F568M-07.....Carbon and Alloy Steel Externally Threaded Metric
Fasteners
F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and Studs
F844-07.....Washers, Steel, Plain (Flat), Unhardened for
General Use
- C. American Concrete Institute (ACI):
ACI 211.1-91(R2009)..Selecting Proportions for Normal, Heavyweight and
Mass Concrete (Reapproved 2002)
ACI 318-11.....Building Code Requirements for Structural Concrete
- D. American Association of State Highway and Transportation Officials
AASHTO LRFD-2010.....LRFD Bridge Design Specifications, U.S., 3rd
Edition
AASHTO M251-06.....Elastomeric Bearings
- E. Precast/Prestressed Concrete Institute (PCI):
MNL-117-96.....Quality Control for Plants and Production of
Architectural Precast Concrete Products
MNL-120-04.....Design Handbook - Precast and Prestressed Concrete

- MNL-124-08.....Design for Fire Resistance of Precast Prestressed Concrete.
- MNL-127-99.....Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products
- MNL-135-00.....Tolerance Manual for Precast and Prestressed Concrete Construction
- TR-6-03.....Interim Guidelines for the Use of Self-Consolidating Concrete
- F. Military Specifications (MIL. Spec):
 - MIL-C882E-89.....Cloth, Duck, Cotton or Cotton-Polyester Blend Synthetic Rubber, Impregnated, and Laminated, Oil Resistant.
- G. Structural Steel Painting Council (SSPC):
 - SSPC-Paint 20 (2002).Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic).

PART 2 - PRODUCTS

2.1 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; non-reactive with concrete and suitable for producing required finishes:
 - 1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Provide solid backing and form supports to ensure that form liners remain in place during concrete placement. Use with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.2 REINFORCING MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
- B. Weldable Reinforcing Bars: ASTM A706/A706M, deformed.
 - 1. Galvanized Reinforcing Bars: ASTM A767/A767M, Class II zinc coated, hot-dip galvanized and chromate wash treated after fabrication and bending.

2. Epoxy-Coated Reinforcing Bars: ASTM A775/A775M or ASTM A934/A934M.
3. Steel Bar Mats: ASTM A184/A184M, assembled with clips.
 - a. Plain-Steel Welded Wire Reinforcement: ASTM A185, fabricated from as-drawn steel wire into flat sheets.
 - b. Deformed-Steel Welded Wire Reinforcement: ASTM A497, flat sheet.
- C. Prestressing Strand: ASTM A416/A416M, Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation strand.
- D. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I or III.
 1. For surfaces exposed to view in finished structure, use white, same type, brand, and mill source throughout the precast concrete production.
 2. Standard gray Portland cement may be used for non-exposed backup concrete.
- B. Supplementary Cementitious Materials for unexposed surfaces (backup concrete) only.
 1. Fly Ash Admixture: ASTM C618, Class C or F with maximum loss on ignition of 3 percent.
 2. Metakaolin Admixture: ASTM C618, Class N.
 3. Silica Fume Admixture: ASTM C1240 with optional chemical and physical requirement.
 4. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33, with coarse aggregates complying with Class 5S. Provide and stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for entire project.
 1. Face-Mix Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - a. Gradation: Uniformly graded.
 - b. Hard durable quartz, marble, or granite aggregate carefully graded from coarse to fine in proportions required to match approved samples.
 - c. Eliminate off color material from exposed aggregate.

2. Face-Mix Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by COR.
 - a. Test sand for color value in accordance with ASTM C40. Sand producing darker than specified color standard is unacceptable.
 - b. Clean washed white sand.
- D. Lightweight Coarse Aggregate: Except as modified by PCI MNL 117, ASTM C 330, with absorption less than 11 percent and free from expanded clay.
- E. Unexposed Surface (Backup) Concrete Aggregates: ASTM C33.
- F. Admixtures: Admixtures containing calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture are not permitted.
 1. Coloring Admixture: ASTM C979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable and non-fading.
 2. Air Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
 3. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 4. Retarding Admixture: ASTM C494/C494M, Type B.
 5. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 6. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 7. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 8. Plasticizing Admixture for Flowable Concrete: ASTM C1017/C1017M.
- G. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

2.4 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A36/A36M except silicon (Si) content in the range of 0 to 0.03% or 0.15 to 0.25% for materials to be galvanized. Steel with chemistry conforming to the formula $Si + 2.5P \leq 0.09$ is also acceptable.
- B. Carbon-Steel Headed Studs: ASTM A108, Grades 1018 through 1020, cold finished and bearing the minimum mechanical properties for studs as indicated under PCI MNL 117, Table 3.2.3.; AWS D1.1, Type A or B, with arc shields.
- C. Carbon-Steel Plate: ASTM A283/A283M.
- D. Malleable Iron Castings: ASTM A47/A47M. Grade 32510.
- E. Carbon-Steel Castings: ASTM A27/A27M, Grade U-60-30 (Grade 415-205).

- F. High-Strength, Low-Alloy Structural Steel: ASTM A572/A572M except silicon (Si) content in the range of 0 to 0.03% or 0.15 to 0.25% for materials to be galvanized. Steel with chemistry conforming to the formula $Si + 2.5P \leq 0.09$ is also acceptable.
- G. Carbon-Steel Structural Tubing: ASTM A500, Grade B.
- H. Wrought Carbon-Steel Bars: ASTM A675/A675M, Grade 65 (Grade 450).
- I. Deformed-Steel Wire or Bar Anchors: ASTM A496 or ASTM A706/A706M.
- J. Carbon-Steel Bolts and Studs: ASTM A307, Grade A (ASTM F568M, Property Class 4.6) carbon-steel, hex-head bolts and studs; carbon-steel nuts (ASTM A563/A563M, Grade A); and flat, unhardened steel washers (ASTM F844).
- K. High-Strength Bolts and Nuts: ASTM A325/A325M or ASTM A490/A490M, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, (ASTM A563/A563M) and hardened carbon-steel washers (ASTM F436/F436M).
- L. Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A123/A123M, after fabrication, or ASTM A153/A153M, as applicable.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with SSPC-Paint 20.
- M. Welding Electrodes: Comply with AWS standards.

2.5 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A666, Type 304, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F593, alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless steel washers. Lubricate threaded parts of stainless steel bolts with an anti-seize thread lubricant during assembly.
- C. Stainless-Steel Headed Studs: ASTM A276 and bearing the minimum mechanical properties for studs as indicated under PCI MNL 117, Table 3.2.3.

2.6 BEARING PADS AND OTHER ACCESSORIES

- A. Provide bearing pads for units as follows:
 - 1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer according to ASTM D2240, minimum tensile strength 15.5 MPa (2250 psi) per ASTM D412.
 - 2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer according to ASTM D2240. Capable of supporting a

- compressive stress of 20.7 MPa (3000 psi) with no cracking, splitting or delaminating in the internal portions of the pad. Test one specimen for each 200 pads used in the project.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer according to ASTM D2240. Conforming to Division II, Section 18.10.2 of AASHTO LFRD, or MIL-C-882E.
 4. Frictionless Pads: Tetrafluoroethylene (teflon), glass-fiber reinforced, bonded to stainless or mild-steel plates, of type required for in-service stress.
 5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.
- B. Reglets: Stainless steel, ASTM A167, Type 302 felt or fiber filled or cover face opening of slots.
- C. Vents and Weeps: Polyvinyl chloride plastic tubing, 9.5 mm (3/8-inch) inside diameter.
- D. Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install units.

2.7 GROUT MATERIALS

- A. Sand-Cement Grout: Portland Cement, ASTM C150, Type I, and clean, natural sand, ASTM C144, or ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, Grade A for drypack and Grades B and C for flowable grout and of a consistency suitable for application within a 30-minute working time.
- C. Epoxy-resin grout: Two-component mineral-filled epoxy-resin: ASTM C881 of type, grade, and class to suit requirements.

2.8 FACING UNITS AND ACCESSORIES

- A. Refer to the related specification for facing units and facing accessories.
- B. Epoxy Anchor Hole Filler: ASTM C881, 100 percent solids, sand-filled non-shrinking, non-staining of type, class, and grade to suit application.

2.9 CONCRETE MIXES

- A. Prepare design mixes to match COR's sample for each type of concrete required.

1. Limit use of fly ash and granulated blast-furnace slag to 40 percent replacement of Portland cement by weight; metakaolin and silica fume to 10 percent of Portland cement by weight.
- B. Design mixes shall be prepared by a qualified independent testing agency or by qualified precast plant personnel at fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested in accordance with ASTM C1218/C1218M.
- D. Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on project, to provide normal-weight concrete with the following properties:
 1. Compressive Strength (28 Days): 34.5 MPa (5000 psi).
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Release Strength at Transfer of Prestress: 24.1 MPa (3500 psi).
- E. Lightweight Concrete Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
 1. Compressive Strength (28 Days): 34.5 MPa (5000 psi).
 2. Unit Weight: Calculated equilibrium unit weight of 1842 kg/cu.m (115 lb/cu.ft.), plus or minus 48 kg/cu.m (3 lb/cu.ft.), according to ASTM C567.
- F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
- G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- H. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

2.11 MOLD FABRICATION

- A. Molds: Accurately construct and maintain molds, mortar tight, within fabrication tolerances and of sufficient strength to withstand pressures due to concrete-placement and vibration operations and temperature changes and for prestressing and detensioning operations.
 1. Form joints are not permitted on faces exposed to view in the finished work.
 2. Edge and Corner Treatment: Uniformly chamfered.

3. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during placing of concrete.
4. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

2.12 SETTING FACING UNITS

- A. Place form liner templates accurately to provide grid for brick facings. Provide solid backing and supports to maintain stability of liners while placing bricks and during placing of concrete.
- B. Securely place brick units face down into form liner pockets and place precast concrete backing mix.
- C. Clean faces and joints of brick facing.

2.13 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
Weld headed studs and deformed bar anchors used for anchorage.
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in units as indicated.
- D. Cast-in openings larger than 250 mm (10 inches) in any dimension. Do not drill or cut openings or reinforcing without approval of COR.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabrication, placing, and supporting reinforcement.
 1. Place reinforcing steel and prestressing strand to maintain at least code minimum concrete cover. Increase cover requirements for reinforcing steel to 38 mm (1-1/2 inches) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete.
 2. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps,

- where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Prestress tendons for units by pretensioning methods. Comply with PCI MNL 117.
1. Protect strand ends and anchorages with bituminous to prevent corrosion and rust spots.
- G. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.
1. At the fabricator's option either of the following mix design/casting techniques may be used:
 - a. A single design mix throughout the entire thickness of panel.
 - b. Design mixes for facing and backup; using cement and aggregates for each type as indicated, for consecutive placement in the mold. Use cement and aggregate specified for facing mix, use cement and aggregate for backup mix complying with criteria specified as selected by the fabricator.
- H. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117.
1. Place backup concrete to ensure bond with face mix concrete.
 2. Place self-consolidating concrete without vibration in accordance with PCI TR-6.
- I. Identify pickup points of units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each unit on a surface that will not show in finished structure.
- J. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam.
- K. Repair damaged units to meet acceptability requirements of PCI MNL 117 and the COR.

2.14 INSULATED PANEL CASTING

- A. Cast and screed supported wythe over mold.
- B. Place insulation boards, abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.
- C. Cast and screed top wythe to meet required finish.

2.15 FABRICATION TOLERANCES

- A. Fabricate units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
 - 1. Additional Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
 - a. Location of Bearing Surface from End of Member: Plus or Minus 6 mm (1/4 inch).
 - b. Position of Sleeve: Plus or Minus 13 mm (1/2 inch).
 - c. Location of Window Washer Track or Buttons: Plus or Minus 3 mm (1/8 inch).
- B. Fabricate architectural trim units such as sills, lintels, coping, cornices, quoins, medallions, bollards, benches, planters, and pavers, with tolerances meeting PCI MNL 135.
- C. Brick-Faced Architectural Precast Concrete Units.
 - 1. Alignment of mortar joints:
 - a. Jog in Alignment: 3 mm (1/8 inch).
 - b. Alignment with Panel Centerline: Plus or Minus 3 mm (1/8 inch).
 - 2. Variation in Width of Exposed Mortar Joints: Plus or Minus 6 mm (1/4 inch).
 - 3. Tipping of Individual Bricks from the Panel Plane of Exposed Brick Surface: Plus 1.5 mm (1/16 inch); Minus 6 mm (1/4 inch) < depth of form liner joint.
 - 4. Exposed Brick Surface Parallel to Primary Control Surface of Panel: Plus 6 mm (1/4 inch); Minus 3 mm (1/8 inch).
 - 5. Individual Brick Step in Face from Panel Plane of Exposed Brick Surface: Plus 1.5 mm (1/16 inch); Minus 6 mm (1/4 inch) < depth of form liner joint.

2.16 FINISHES

- A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight and sharp. Finish exposed-face surfaces of units to match approved design reference sample, and mockups and as follows:
 - 1. PCI's "Architectural Precast Concrete -Color and Texture Selection Guide," of plate numbers indicated.
 - 2. As-Cast Surface Finish: Provide surfaces free of excessive air voids, sand streaks, and honeycombs.

3. Textured-Surface Finish: Impart by form liners to provide surfaces free of excessive air voids, sand streaks, and honeycombs, with uniform color and texture.
 4. Bushhammer Finish: Use power and hand tools to remove matrix and fracture coarse aggregates.
 5. Exposed Aggregate Finish: Use chemical retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
 6. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 7. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections and insulation from acid attack.
 8. Honed Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 9. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 10. Sand-Embedment Finish: Use selected stones placed in a sand bed in bottom of mold, with sand removed after curing.
- B. Finish exposed top, bottom surfaces of units to match face-surface finish.
- C. Finish unexposed surfaces top, bottom and back of units by smooth steel-trowel finish.
- D. Finish unexposed surfaces of units by float finish.

2.17 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to Section 01 45 29, TESTING LABORATORY SERVICES and PCI MNL 117 requirements respectively. If using self-consolidating concrete also test and inspect according to PCI TR-6.
- B. Testing: If there is evidence that the concrete strength of precast concrete units may be deficient, Precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to PCI MNL 117:
1. Test results will be made in writing on the same day that tests are performed, with copies to COR, Contractor, and precast concrete fabricator. Test reports will include the information required in Section TESTING LABORATORY SERVICES and the following:

- a. Identification mark and type of precast concrete units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- C. Defective or Damaged Work: Units that do not comply with acceptability requirements, including concrete strength, manufacturing tolerances, and color and texture range are unacceptable. Chipped, spalled or cored units may be repaired, if repaired units match the visual mock-up. The COR reserves the right to reject any unit if it does not match the accepted samples and visual mock-up. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Deliver anchorage devices that are embedded in or attached to the building structural frame or foundation before start of such work. Provide locations, setting diagrams, and templates for the proper installation of each anchorage device.
- B. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install units until supporting structure is structurally ready to receive loads from precast.

3.2 ERECTION

- A. Erect level, plumb and square within the specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and use sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.

4. Unless otherwise shown provide for uniform joint widths of 19mm (3/4 inch).
- B. Connect units in position by bolting, welding, grouting, or as otherwise indicated on approved Erection Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.
 1. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.
 2. Welding: Comply with applicable requirements for welding.
 - a. Protect units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
 - b. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS.
 - c. Clean weld affected metal surfaces and apply a minimum 100 µm (0.004 inch) thick coat of galvanized repair paint to galvanized surfaces in conformance with ASTM A780.
 - d. Visually inspect all welds critical to precast connections.
Visually check all welds for completion and remove, reweld or repair all defective welds.
 3. At bolted connections, use lock washers, tack welding, or other acceptable means to prevent loosening of nuts after final adjustment.
 - a. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connection apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.
 4. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
- C. Attachments: Upon approval of COR, precast pre-stressed products may be drilled or "shot" for fasteners or small openings. Provided reinforcing or pre-stressing steel is not damaged or cut.
 1. Should spalling occur, repair according to this specification section.
- D. Venting and Weeps: Where precast concrete panels form the outer wythe of cavity wall construction, vent the cavity wall.
 1. Use polyvinyl chloride plastic tubing to vent the cavity.

2. Place plastic vent tubes "tilted down and out" in horizontal and vertical joints.
 3. Space vent tubes in accordance with shop drawings, but not less than two vents per panel or approximately 1220 mm (4 feet) on centers.
- E. Setting: Where shown, fill joints with cement mortar specified in Section 04 05 13, MASONRY MORTARING.
1. Clean surfaces forming beds and other joints for precast concrete panels of dust, dirt, and other foreign matter, and wet thoroughly to prevent suction before precast concrete, elements are set.
 2. Set precast element level and true to line with uniform joints filled completely with mortar.
Rake out joints 25 mm (1-inch) deep for pointing or sealants.
Joints required to have only sealant: Kept free of mortar for full depth.
 3. Keep exposed faces of precast concrete elements free of mortar.
 4. Remove wedges, spacers, or other appliances which are likely to cause staining from joints.
 5. Where parging is shown, parge back of elements solid with mortar.
Apply parging without skips or holidays.
- F. Pointing: Wash and brush clean, leaving joints free from loose mortar, dust and other foreign material.
1. Carefully point with a slightly concave joint.
 2. Mortar for pointing as specified in Section 04 05 13, MASONRY MORTARING
Use same material and color sand used in fabrication of precast concrete elements when specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- G. Sealing of Joints: Where shown and where required to make work watertight: clean, dry and seal joints between precast concrete elements and between precast elements and adjoining materials as specified in Section 07 92 00, JOINT SEALANTS.
- H. Mortaring at welded connections: provide masonry grout matching existing concrete to cover all welded connections for precast to concrete structure in accordance with Section 04 05 13, MASONRY MORTARING.

3.3 ERECTION TOLERANCES

- A. Erect units level, plumb, square, true, and in alignment without exceeding the erection tolerances of PCI MNL 117, Appendix I.

3.4 FIELD QUALITY CONTROL

- A. Refer to Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Testing agency will report test results promptly and in writing to Contractor and COR.
- C. Repair or remove and replace work that does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS

- A. Repairs will be permitted provided structural adequacy of units and appearance are not impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 6 m (20 feet).
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780.
- D. Remove and replace damaged units when repairs do not meet requirements.

3.6 CLEANING

- A. Clean all surfaces of precast concrete to be exposed to view, as necessary, prior to shipping.
- B. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

- - - E N D - - -

SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies mortar materials and mixes.

1.2 RELATED WORK:

A. Mortar used in Section:

1. Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE.
2. Section 04 05 16, MASONRY GROUTING.
3. Section 04 20 00, UNIT MASONRY.
4. Section 04 72 00, CAST STONE MASONRY.

B. Mortar Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 TESTING LABORATORY-CONTRACTOR RETAINED

- A. Engage a commercial testing laboratory approved by Contracting Officer Representative to perform tests specified below.
- B. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Contracting Officer Representative.

1.4 TESTS

- A. Test mortar and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by Contracting Officer Representative.
- E. After tests have been made and materials approved, do not change without additional test and approval of Contracting Officer Representative.
- F. Testing:
 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
 2. Mortar:
 - a. Test for compressive strength and water retention; ASTM C270.
 - b. Mortar compressive strengths 28 days as follows:
Type M: Minimum 17230 kPa (2500 psi) at 28 days.
Type S: Minimum 12400 kPa (1800 psi) at 28 days.
Type N: Minimum 5170 kPa (750 psi) at 28 days.
 3. Cement:

- a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 - b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.
- 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.
- G. During progress of work, testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES, takes and tests samples as specified in that section. Testing procedures and test methods in ASTM C780.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
 - 2. Indicating that following items meet specifications:
 - a. Portland cement.
 - b. Masonry cement.
 - c. Mortar cement.
 - d. Hydrated lime.
 - e. Fine aggregate (sand).
 - g. Color admixture.
- C. Laboratory Test Reports:
 - 1. Mortar, each type.
 - 2. Admixtures.
- D. Manufacturer's Literature and Data:
 - 1. Cement, each kind.
 - 2. Hydrated lime.
 - 3. Admixtures.
 - 4. Liquid acrylic resin.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C40-04.....Organic Impurities in Fine Aggregates for Concrete

C91-05.....Masonry Cement
C109-08.....Compressive Strength of Hydraulic Cement Mortars
(Using 2-in. or 50-MM Cube Specimens)
C144-04.....Aggregate for Masonry Mortar
C150-09.....Portland Cement
C207-06.....Hydrated Lime for Masonry Purposes
C270-10.....Mortar for Unit Masonry
C307-03(R2008).....Tensile Strength of Chemical - Resistant Mortar,
Grouts, and Monolithic Surfacing
C321-00(R2005).....Bond Strength of Chemical-Resistant Mortars
C348-08.....Flexural Strength of Hydraulic Cement Mortars
C595-10.....Blended Hydraulic Cement
C780-10.....Preconstruction and Construction Evaluation of
Mortars for Plain and Reinforced Unit Masonry
C979-10.....Pigments for Integrally Colored Concrete
C1329-05.....Mortar Cement

PART 2 - PRODUCTS

2.1 HYDRATED LIME

ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY MORTAR

A. ASTM C144 and as follows:

1. Light colored sand for mortar for laying face brick.
2. White plastering sand meeting sieve analysis for mortar joints for pointing

B. Test sand for color value in accordance with ASTM C40. Sand producing color darker than specified standard is unacceptable.

2.3 BLENDED HYDRAULIC CEMENT

ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT

A. ASTM C91. Type N, S, or M.

B. Use white masonry cement whenever white mortar is specified.

2.5 MORTAR CEMENT

ASTM C1329, Type N, S or M.

2.6 PORTLAND CEMENT

A. ASTM C150, Type I.

B. Use white Portland cement wherever white mortar is specified.

2.7 LIQUID ACRYLIC RESIN

A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

2.8 WATER

Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.9 POINTING MORTAR

- A. For Cast Stone or Precast Concrete: Proportion by volume; One part white Portland cement, two parts white sand, and 1/5 part hydrated lime.
- B. Pointing Mortar for Glazed Structural Facing Tile:
 - 1. Proportion by volume: One part white Portland cement, two parts of graded white sand passing Number 50 sieve, and 1/8 part hydrated lime.

2.10 MASONRY MORTAR

- A. Conform to ASTM C270.
- B. Admixtures:
 - 1. Do not use mortar admixtures, except for color admixtures unless approved by Contracting Officer Representative.
 - 2. Submit laboratory test report showing effect of proposed admixture on strength, water retention, and water repellency of mortar.
 - 3. Do not use antifreeze compounds.
- C. Colored Mortar:
 - 1. Maintain uniform mortar color for exposed work throughout.
 - 2. Match mortar color in approved sample or mock-up.
 - 3. Color of mortar for exposed work in alteration work to match color of existing mortar unless specified otherwise in section 09 06 00, SCHEDULE FOR FINISHES.
- D. Color Admixtures:
 - 1. Proportion as specified by manufacturer.
 - 2. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.

2.11 HIGH BOND MORTAR

- A. Mixture by volume, one-part Portland cement, 1/4-part hydrated lime, three-parts sand, water, and liquid acrylic resin.
- B. Mortar properties when tested in accordance with referenced specifications.
 - 1. Compressive Strength, ASTM C109: Minimum 19,305 kPa (2800 psi), using 50 mm (2 inch) cubes.
 - 2. Tensile Strength, ASTM C307: 3861 kPa Minimum (560 psi), using the 25mm (1 inch) briquettes.
 - 3. Flexural Strength, ASTM C348: Minimum 6067 kPa (880 psi), using flexural bar.
 - 4. Bond Strength, ASTM C321: Minimum 2965 kPa (430 psi), using crossed brick.

2.12 COLOR ADMIXTURE

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

PART 3 - EXECUTION

3.1 MIXING

- A. Mix in a mechanically operated mortar mixer.
 - 1. Mix mortar for at least three minutes but not more than five minutes.
- B. Measure ingredients by volume. Measure by the use of a container of known capacity.
- C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
- D. Mortar that has stiffened because of loss of water through evaporations:
 - 1. Re-tempered by adding water to restore to proper consistency and workability.
 - 2. Discard mortar that has reached its initial set or has not been used within two hours.
- E. Pointing Mortar:
 - 1. Mix dry ingredients with enough water to produce a damp mixture of workable consistency which will retain its shape when formed into a ball.
 - 2. Allow mortar to stand in dampened condition for one to 1-1/2 hours.
 - 3. Add water to bring mortar to a workable consistency prior to application.

3.2 MORTAR USE LOCATION

- A. Use Type M mortar for precast concrete panels, waterproof parging below grade.
- B. Use Type S mortar for masonry containing vertical reinforcing bars (non-engineered), masonry below grade setting cast stone, and engineered reinforced unit masonry work .
- C. D. Use Type N mortar for other masonry work, except as otherwise specified.

- - - E N D - - -

SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies grout materials and mixes.

1.2 RELATED WORK:

- A. Grout used in Section:
 - 1. Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE.
 - 2. Section 04 20 00, UNIT MASONRY.
 - 3. Section 04 72 00, CAST STONE MASONRY.
- B. Grout Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 TESTS:

- A. Test grout and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by Contracting Officer Representative.
- E. After tests have been made and materials approved, do not change without additional test and approval of Contracting Officer Representative.
- F. Testing:
 - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
 - 2. Grout:
 - a. Test for compressive strength; ASTM C1019.
 - b. Grout compressive strength of 13790 kPa (2000 psi) at 28 days.
 - 3. Cement:
 - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 - b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.
 - 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.4 SUBMITTALS:

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

1. Indicating that following items meet specifications:

- a. Portland cement.
- b. Masonry cement.
- c. Grout.
- d. Hydrated lime.
- e. Fine aggregate (sand).
- f. Coarse aggregate for grout.
- g. Color admixture.

C. Laboratory Test Reports:

1. Grout, each type.
2. Admixtures.

D. Manufacturer's Literature and Data:

1. Cement, each kind.
2. Hydrated lime.
3. Admixtures.
4. Liquid acrylic resin.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C40-04.....Organic Impurities in Fine Aggregates for
Concrete
 - C91-05.....Masonry Cement
 - C150-09.....Portland Cement
 - C207-06.....Hydrated Lime for Masonry Purposes
 - C404-07.....Aggregate for Masonry Grout
 - C476-10.....Grout for Masonry
 - C595-10.....Blended Hydraulic Cement
 - C979-10.....Pigments for Integrally Colored Concrete
 - C1019-11.....Sampling and Testing Grout

PART 2 - PRODUCTS

2.1 HYDRATED LIME:

ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY GROUT:

ASTM C404, Size 8.

2.3 BLENDED HYDRAULIC CEMENT:

ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT:

A. ASTM C91. Type N, S, or M.

B. Use white masonry cement whenever white mortar is specified.

2.5 PORTLAND CEMENT:

A. ASTM C150, Type I.

B. Use white Portland cement wherever white mortar is specified.

2.6 LIQUID ACRYLIC RESIN:

A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

2.7 WATER:

Potable, free of substances that are detrimental to grout, masonry, and metal.

2.8 GROUT:

A. Conform to ASTM C476 except as specified.

B. Grout type proportioned by volume as follows:

1. Fine Grout:

a. Portland cement or blended hydraulic cement: one part.

b. Hydrated lime: 0 to 1/10 part.

c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.

2. Coarse Grout:

a. Portland cement or blended hydraulic cement: one part.

b. Hydrated lime: 0 to 1/10 part.

c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.

d. Coarse aggregate: one to two times sum of volumes of cement and lime used.

3. Sum of volumes of fine and coarse aggregates: Do not exceed four times sum of volumes of cement and lime used.

2.9 COLOR ADMIXTURE:

A. Pigments: ASTM C979.

B. Use mineral pigments only. Organic pigments are not acceptable.

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Salisbury, NC 28144

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- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

PART 3 - EXECUTION

3.1 MIXING:

- A. Mix in a mechanically operated grout mixer.
 - 1. Mix grout for at least five minutes.
- B. Measure ingredients by volume. Measure by the use of a container of known capacity.
- C. Mix water with grout dry ingredients in sufficient amount to bring grout mixture to a pouring consistency.

3.2 GROUT USE LOCATIONS:

- A. Use fine grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is 50 mm (2 inches) or less.
- B. Use either fine grout or coarse grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is greater than 50 mm (2 inches).
- C. Do not use grout for filling bond beam or lintel units.

- - - E N D - - -

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for construction of masonry unit walls.

1.2 RELATED WORK

- A. Mortars and grouts : Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING.
- B. Steel lintels and shelf angles: Section 05 50 00, METAL FABRICATIONS.
- C. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
- D. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.
- E. Color and texture of masonry units: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Face brick, sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
 - 2. Concrete masonry units, when exposed in finish work.
 - 3. Anchors, and ties, one each and joint reinforcing 1200 mm (48 inches) long.
- C. Shop Drawings:
 - 1. Special masonry shapes.
 - 2. Drawings, showing reinforcement, applicable dimensions and methods of hanging soffit or lintel masonry and reinforcing masonry for embedment of anchors for hung fixtures.
 - 3. Ceramic glazed structural facing tile or concrete masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.
 - 4. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.
- D. Certificates:

1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
2. Indicating that the following items meet specification requirements:
 - a. Face brick.
 - b. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
 - c. concrete masonry unit.
3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.

E. Laboratory Test Reports:

1. Brick for pre-built masonry panels.
2. Ceramic glazed facing brick.

F. Manufacturer's Literature and Data:

1. Anchors, ties, and reinforcement.
2. Shear keys.
3. Reinforcing bars.

1.4 SAMPLE PANEL

- A. Before starting masonry, lay up a sample panel in accordance with Masonry Standards Joint Committee (MSJC) and Brick Industry Association (BIA).
 1. Use masonry units from random cubes of units delivered on site.
 2. Include reinforcing, ties, and anchors.
- B. Use sample panels approved by Contracting Officer Representative for standard of workmanship of new masonry work.
- C. Use sample panel to test cleaning methods.

1.5 WARRANTY

Warrant exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A951-06.....Steel Wire for Masonry Joint Reinforcement.
 - A615/A615M-09.....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - A675/A675M-03(R2009)....Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical

- PropertiesC34-03 Structural Clay Load-Bearing
Wall Tile
- C55-09.....Concrete Building Brick
- C56-10.....Structural Clay Non-Load-Bearing Tile
- C62-10.....Building Brick (Solid Masonry Units Made From
Clay or Shale)
- C67-09.....Sampling and Testing Brick and Structural Clay
Tile
- C90-11.....Load-Bearing Concrete Masonry Units
- C126-10.....Ceramic Glazed Structural Clay Facing Tile,
Facing Brick, and Solid Masonry Units
- C216-10.....Facing Brick (Solid Masonry Units Made From Clay
or Shale)
- C476-10.....Standard Specification for Grout for Masonry
- C612-10.....Mineral Fiber Block and Board Thermal Insulation
- C744-11.....Prefaced Concrete and Calcium Silicate Masonry
Units.
- D1056-07.....Flexible Cellular Materials - Sponge or Expanded
Rubber
- D2000-08.....Rubber Products in Automotive Applications
- D2240-05(R2010).....Rubber Property - Durometer Hardness
- D3574-08.....Flexible Cellular Materials-Slab, Bonded, and
Molded Urethane Foams
- F1667-11.....Fasteners: Nails, Spikes and Staples
- C. Masonry Industry Council:
Hot and Cold Weather Masonry Construction Manual-98 (R2000).
- D. American Welding Society (AWS):
D1.4-11 Structural Welding Code - Reinforcing Steel.
- E. Federal Specifications (FS):
FF-S-107C-00.....Screws, Tapping and Drive
- F. Brick Industry Association - Technical Notes on Brick Construction
(BIA):
11-2001.....Guide Specifications for Brick Masonry, Part I
11A-1988.....Guide Specifications for Brick Masonry, Part II
11B-1988.....Guide Specifications for Brick Masonry, Part III
Execution
11C-1998.....Guide Specification for Brick Masonry Engineered
Brick Masonry, Part IV
11D-1988.....Guide Specifications for Brick Masonry
Engineered Brick Masonry, Part IV continued

- G. Masonry Standards Joint Committee; Specifications for Masonry Structures
TMS 602-08/ACI 530.1-08/ASCE 6-08 (2008 MSJC Book Version TMS-0402-08).

PART 2 - PRODUCTS

2.1 BRICK

A. Face Brick:

1. ASTM C216, Grade SW, Type FBS.
2. Brick when tested in accordance with ASTM C67: Classified slightly efflorescent or better.
3. Size:
 - a. Modular
 - b. Thin Brick: 13 mm (1/2 inch) thick with angle shapes for corners.
4. Color and Texture: match existing Boral Brick, MOD 32, Red Range Wirecut, ASTM C-216, Grade SC, Type FBS. Present options to Architect for approval.

- B. Ceramic Glazed Facing Brick: ASTM C126; Grade S, Type I (single-faced units) where only one face is exposed; Grade S, Type II (two-faced units) where two opposite finished faces are exposed.

2.2 CONCRETE MASONRY UNITS AND GLAZED CONCRETE MASONRY UNITS

A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.

1. Unit Weight: Normal weight.
2. Sizes: Modular.
3. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.

- B. Concrete Brick: ASTM C55.

2.3 SHEAR KEYS

- A. ASTM D2000, solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with a durometer hardness of approximately 80 when tested in accordance with ASTM D2240, and a minimum shear strength of 3.5 MPa (500 psi).
- B. Shear key dimensions: Approximately 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

2.4 ANCHORS, TIES, AND REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown.
- B. Joint Reinforcement:
1. Form from wire complying with ASTM A951.

2. Galvanized after fabrication.
 3. Width of joint reinforcement 40 mm (0.16 inches) less than nominal width of masonry wall or partition.
 4. Cross wires welded to longitudinal wires.
 5. Joint reinforcement at least 3000 mm (10 feet) in length.
 6. Joint reinforcement in rolls is not acceptable.
 7. Joint reinforcement that is crimped to form drip is not acceptable.
 8. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
 9. Ladder Design:
 - a. Longitudinal wires deformed 5 mm (0.20 inch) diameter wire.
 - b. Cross wires 4 mm (0.16 inch) diameter.
 10. Trussed Design:
 - a. Longitudinal and cross wires not less than 4 mm (0.16 inch nominal) diameter.
 - b. Longitudinal wires deformed.
 11. Multiple Wythes and Cavity wall ties:
 - a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.
 - b. Longitudinal wires 4 mm (0.16 inch) with U shape 4 mm (0.16 inch) rectangular ties extending into other wythe not less than 75 mm (3 inches) spaced 400 mm o.c. (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches min.).
- C. Adjustable Veneer Anchor for Frame Walls:
1. Two piece, adjustable anchor and tie.
 2. Anchor and tie may be either type; use only one type throughout.
 3. Loop Type:
 - a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
 - b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage the anchor and be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer.
 4. Angle Type:
 - a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide

hole near end of outstanding leg to suit upstanding portion of tie.

- b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

D. Dovetail Anchors:

1. Corrugated steel dovetail anchors formed of 1.5 mm (0.0598 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.
2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend at least 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
3. Form dovetail anchor slots from 0.6 mm (0.0239 inch) thick galvanized steel (with felt or fiber filler).

E. Individual ties:

1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to a rectangular shape not less than 50 mm (2 inches) wide by sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not permitted.
2. Adjustable Cavity Wall Ties:
 - a. Adjustable wall ties may be used at Contractor's option.
 - b. Two piece type permitting up to 40 mm (1-1/2 inch) adjustment.
 - c. Form ties from 5 mm (3/16 inch) diameter galvanized steel wire.
 - d. Form one piece to a rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into the bed joint 50 mm (2 inches).
 - e. Form the other piece to a 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having a 75 mm (3 inch) long bent section for engaging the 105 mm (4-1/8 inch) wide piece to form adjustable connection.

F. Wall Ties, (Mesh or Wire):

1. Mesh wall ties formed of ASTM A82, W0.5, 2 mm, (16 gage) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
2. Rectangular wire wall ties formed of W1.4, 3 mm, (9 gage) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.

G. Corrugated Wall Tie:

1. Form from 1.5 mm (0.0598 inch) thick corrugated, galvanized steel 30 mm (1-1/4 inches) wide by lengths so as to extend at least 100 mm (4 inches) into joints of new masonry plus 38 mm (1-1/2 inch) turn-up.
2. Provide 5 mm (3/16 inch) hole in turn-up for fastener attachment.

H. Adjustable Steel Column Anchor:

1. Two piece anchor consisting of a 6 mm (1/4 inch) diameter steel rod to be welded to steel with offset ends, rod to permit 100 mm (4 inch) vertical adjustment of wire anchor.
2. Triangular shaped wire anchor 100 mm (4 inches) wide formed from 5 (3/16 inch) diameter galvanized wire, to extend at least 75 mm (3 inches) into joints of masonry.

I. Adjustable Steel Beam Anchor:

1. Z or C type steel strap, 30 mm (1 1/4 inches) wide, 3 mm (1/8 inch) thick.
2. Flange hook not less than 38 mm (1 1/2 inches) long.
3. Length to embed in masonry not less than 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
4. Bend masonry end not less than 40 mm (1 1/2 inches).

J. Ridge Wall Anchors:

1. Form from galvanized steel not less than 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
2. Other lengths as shown.

2.5 PREFORMED COMPRESSIBLE JOINT FILLER

- A. Thickness and depth to fill the joint as specified.
- B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
- C. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees F.

2.6 ACCESSORIES

- A. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
- B. Box Board:
 1. Mineral Fiber Board: ASTM C612, Class 1.
 2. 25 mm (1 inch) thickness.
 3. Other spacing material having similar characteristics may be used subject to the Contracting Officer Representative's approval.
- C. Masonry Cleaner:
 1. Detergent type cleaner selected for each type masonry used.
 2. Acid cleaners are not acceptable.

3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

D. Fasteners:

1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

2.7 PRE-BUILT MASONRY PANELS

- A. Shop fabricated under a controlled environment, in a plant capable of manufacturing, transporting, and storing the finished panels.
- B. Fabricate panels to size and configuration shown, conforming to approved shop drawing.
- C. Fabricate panels in jigs.
- D. Reject panels failing to meet these requirements.
 1. Plumb head joints.
 2. Panel dimensions tolerances: Accurate to plus 0 mm (0 inch) and minus 6 mm (1/4 inch) in 3600 mm (12 feet).
 3. Panels true, free of warp or rack, and plumb on base.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Protection:
 1. Cover tops of walls with nonstaining waterproof covering, when work is not in progress. Secure to prevent wind blow off.
 2. On new work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site work is completed.
- B. Cold Weather Protection:
 1. Masonry may be laid in freezing weather when methods of protection are utilized.
 2. Comply with MSJC and "Hot and Cold Weather Masonry Construction Manual".

3.2 CONSTRUCTION TOLERANCES

- A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:
- B. Maximum variation from plumb:
 1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
 2. In 6000 mm (20 feet) - 10 mm (3/8 inch).
 3. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- C. Maximum variation from level:

1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
 2. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- D. Maximum variation from linear building lines:
1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
 2. In 12 000 mm (40 feet) or more - 19 mm (3/4 inch).
- E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
1. Minus 6 mm (1/4 inch).
 2. Plus 13 mm (1/2 inch).
- F. Maximum variation in prepared opening dimensions:
1. Accurate to minus 0 mm (0 inch).
 2. Plus 6 mm (1/4 inch).

3.3 INSTALLATION GENERAL

- A. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- B. Anchor masonry as specified in Paragraph, ANCHORAGE.
- C. Wall Openings:
1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
 2. If items are not available when walls are built, prepare openings for subsequent installation.
- D. Tooling Joints:
1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
 2. Tool while mortar is soft enough to be compressed into joints and not raked out.
 3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
 4. Tool Exposed interior joints in finish work concave unless specified otherwise.
- E. Lintels:
1. Lintels are not required for openings less than 1000 mm (3 feet 4 inches) wide that have hollow metal frames.
 2. Openings 1025 mm (3 feet 5 inches) wide to 1600 mm (5 feet 4 inches) wide with no structural steel lintel or frames, require a lintel formed of concrete masonry lintel or bond beam units filled with grout per ASTM C476 and reinforced with 1- #15m (1-#5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.

3. Precast lintels of 25 Mpa (3000 psi) concrete, of same thickness as partition, and with one Number 5 deformed bar top and bottom for each 100 mm (4 inches) of nominal thickness, may be used in lieu of reinforced CMU masonry lintels.
4. Use steel lintels, for openings over 1600 mm (5 feet 4 inches) wide, brick masonry, and elevator openings unless shown otherwise.
5. Doors having overhead concealed door closers require a steel lintel, and a pocket for closer box.
6. Length for minimum bearing of 100 mm (4 inches) at ends.
7. Build masonry openings or arches over wood or metal centering and supports when steel lintels are not used.
8. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.

F. Structural Steel Encased in Masonry:

1. Where structural steel is encased in masonry and the voids between the steel and masonry are filled with mortar, provide a minimum 25 mm (1 inch) mortar free expansion space between the masonry and the steel by applying a box board material to the steel before the masonry is laid.
2. Do not place spacing material where steel is bearing on masonry or masonry is bearing on steel.

G. Wetting and Wetting Test:

1. Test and wet brick or clay tile in accordance with BIA 11B.
2. Do not wet concrete masonry units or glazed structural facing tile before laying.

H. Formwork:

1. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
2. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.
3. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

4. Allow not less than the following minimum time to elapse after completion of members before removing shores or forms, provided suitable curing conditions have been obtained during the curing period.
 - a. 10 days for girders and beams.
 - b. 7 days for slabs.
 - c. 7 days for reinforced masonry soffits.

3.4 ANCHORAGE

A. Veneer to Frame Walls:

1. Use adjustable veneer anchors.
2. Fasten anchor to stud through sheathing with self drilling and tapping screw, one at each end of loop type anchor.
3. Space anchors not more than 400 mm (16 inches) on center vertically at each stud.

B. Veneer to Concrete Walls:

1. Install dovetail slots in concrete vertically at 600 mm (2 feet) on centers.
2. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals.
3. Anchor new masonry facing to existing concrete with corrugated wall ties spaced at 400 mm, (16 inch) maximum vertical intervals, and at 600 mm (2 feet) maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.

C. Masonry Facing to Backup and Cavity Wall Ties:

1. Use individual ties for new work.
2. Stagger ties in alternate courses, and space at 400 mm (16 inches) maximum vertically, and 600 mm (2 feet) horizontally.
3. At openings, provide additional ties spaced not more than 900 mm (3 feet) apart vertically around perimeter of opening, and within 300 mm (12 inches) from edge of opening.
4. Anchor new masonry facing to existing masonry with corrugated wall ties spaced at 400 mm (16 inch) maximum vertical intervals and at every second masonry unit horizontally. Fasten ties to masonry with masonry nails.
5. Option: Use joint reinforcing for multiple wythes and cavity wall ties spaced not more than 400 mm (16 inches) vertically.
6. Tie interior and exterior wythes of reinforced masonry walls together with individual ties. Provide ties at intervals not to exceed 600 mm (24 inches) on center horizontally, and 400 mm (16 inches) on center

vertically. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.

D. Anchorage of Abutting Masonry:

1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (2 foot) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.
2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.
4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with corrugated wall ties. Extend ties at least 100 mm (4 inches) into joints of new masonry. Fastened to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

E. Masonry Furring:

1. Anchor masonry furring less than 100 mm (4 inches) nominal thick to masonry walls or to concrete with corrugated wall ties or dovetail anchors.
2. Space not over 600 mm (2 feet) on centers in both directions.

F. Anchorage to Steel Beams or Columns:

1. Use adjustable beam anchors on each flange.
2. At columns weld the 6 mm (1/4 inch) steel rod to steel columns at 300 mm (12 inch) intervals, and place wire ties in masonry courses at 400 mm (16 inches) maximum vertically.

3.5 REINFORCEMENT

A. Joint Reinforcement:

1. Brick veneer over frame backing walls does not require joint reinforcement.

B. Steel Reinforcing Bars:

1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam

- horizontal reinforcement. Install in wall cavities of reinforced masonry walls where shown.
2. Use grade 60 bars if not specified otherwise.
 3. Bond Beams:
 - a. Form Bond beams of load-bearing concrete masonry units filled with ASTM C476 grout and reinforced with 2-#15m (#5) reinforcing steel unless shown otherwise. Do not cut reinforcement.
 - b. Brake bond beams only at expansion joints and at control joints, if shown.

3.6 BRICK EXPANSION AND CMU CONTROL JOINTS.

- A. Provide brick expansion (BEJ) and CMU control (CJ) joints where shown on drawings or in any section of wall greater than 30 feet. Coordinate location with designer.
- B. Keep joint free of mortar and other debris.
- C. Where joints occur in masonry walls.
 1. Install preformed compressible joint filler in brick wythe.
 2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key unless otherwise specified.
 3. Install filler, backer rod, and sealant on exposed faces.
- D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint. E. Interrupt steel joint reinforcement at expansion and control joints unless otherwise shown.
- F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.7 BUILDING EXPANSION AND SEISMIC JOINTS

- A. Keep joint free of mortar. Remove mortar and other debris.
- B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.
- C. Where joints are on exposed faces, provide depth for backer rod and sealant as specified in Section 07 92 00, JOINT SEALANTS, unless shown otherwise.

3.8 ISOLATION SEAL

- A. Where full height walls or partitions lie parallel or perpendicular to and under structural beams or shelf angles, provide a separation between

walls or partitions and bottom of beams or shelf angles not less than the masonry joint thickness unless shown otherwise.

- B. Insert in the separation, a continuous full width strip of non-combustible type compressible joint filler.
- C. Where exposed in finish work, cut back filler material in the joint enough to allow for the joint to be filled with sealant material specified in Section 07 92 00, JOINT SEALANTS.

3.9 BRICKWORK

- A. Lay clay brick in accordance with BIA Technical Note 11 series.
- B. Laying:
 - 1. Lay brick in running bond with course of masonry bonded at corners unless shown otherwise to match main campus building.
 - 2. Maintain bond pattern throughout.
 - 3. Do not use brick smaller than half-brick at any angle, corner, break or jamb.
 - 4. Where length of cut brick is greater than one half but less than a whole brick, maintain the vertical joint location of such units.
 - 5. Lay exposed brickwork joints symmetrical about center lines of openings.
 - 6. Do not structural bond multi wythe brick walls unless shown.
 - 7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.
 - 8. Lay brick for sills with wash and drip.
 - 9. Build solid brickwork as required for anchorage of items.
- C. Joints:
 - 1. Exterior and interior joint widths: Lay for three equal joints in 200 mm (eight inches) vertically, unless shown otherwise.
 - 2. Rake joints for pointing with colored mortar when colored mortar is not full depth.

3.9 CONCRETE MASONRY AND GLAZED UNITS

- A. Kind and Users:
 - 1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and bull-nose corner units. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.
 - 2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.

3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.
4. Do not use brick jambs in exposed finish work.
5. Use concrete building brick only as filler in backup material where not exposed.

B. Laying:

1. Lay concrete masonry units with 10 mm (3/8 inch) joints, with a bond overlap of not less than 1/4 of the unit length, except where stack bond is required.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
7. Provide a 6 mm (1/4 inch) open joint for caulking between exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings not less than 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge the masonry against the steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes shown.
12. Steel reinforcement, at time of placement, free of loose flaky rust, mud, oil, or other coatings that will destroy or reduce bond.
13. Steel reinforcement in place before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
16. Support vertical bars near each end and at intermediate intervals not exceeding 192 bar diameters.
17. Reinforcement shall be fully encased by grout or concrete.
18. Splice reinforcement or attach reinforcement to dowels by placing in contact and secured or by placing the reinforcement within 1/5 of the required bar splice length.

19. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
20. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
21. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.

3.10 POINTING

- A. Fill joints with pointing mortar using rubber float trowel to rub mortar solidly into raked joints.
- B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.
- C. Finish exposed joints in finish work with a jointing tool to provide a smooth concave joint unless specified otherwise.

3.11 GROUTING

- A. Preparation:
 1. Clean grout space of mortar droppings before placing grout.
 2. Close cleanouts.
 3. Install vertical solid masonry dams across grout space for full height of wall at intervals of not more than 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
 4. Verify reinforcing bars are in cells of units or between wythes as shown.
- B. Placing:
 1. Place grout by hand bucket, concrete hopper, or grout pump.
 2. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
 3. Do not slush with mortar or use mortar with grout.
 4. Interruptions:
 - a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inch) below top of last masonry course.
 - b. Grout from dam to dam on high lift method.
 - c. A longitudinal run of masonry may be stopped off only by raking back one-half a masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.
- C. Puddling Method:
 1. Double wythe masonry constructed grouted in lifts not to exceed 300 mm (12 inches) or less than 50 mm (2 inches) wide.

2. Consolidate by puddling with a grout stick during and immediately after placing.
3. Grout the cores of concrete masonry units containing the reinforcing bars solid as the masonry work progresses.

D. Low Lift Method:

1. Construct masonry to a height of 1.5 m (5 ft) maximum before grouting.
2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

E. High Lift Method:

1. Do not pour grout until masonry wall has properly cured a minimum of 4 hours.
2. Place grout in lifts not exceeding 1.5 m (5 ft).
3. Exception:
Where the following conditions are met, place grout in lifts not exceeding 3.86 m (12.67 ft).
 - a. The masonry has cured for at least 4 hours.
 - b. The grout slump is maintained between 254 and 279 mm (10 and 11 in).
 - c. No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into the preceding lift to close any shrinkage cracks or separation from the masonry units.

3.12 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 25 mm (1 inch), whichever is greater.
- D. Splice reinforcement bars where shown; do not splice at other places unless accepted by the Contracting Officer Representative. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

- E. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- F. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- G. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement not less than 150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- H. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
- I. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

3.13 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

- A. Limit wetting of concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 10 mm (3/8 inch) joints.
- C. Where solid CMU units are shown, lay with full mortar head and bed joints.
- D. Walls:
 - 1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
 - 2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for

vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Grouting:

1. Use "Fine Grout" per ASTM C476 for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use "Coarse Grout" per ASTM C476 for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to requirements which follow.

F. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 mm^2 (8 square inches) in vertical cores to be grouted.
2. Place vertical reinforcement prior to grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 foot) height, or if bond beam occurs below 1.5 m (5 foot) height, stop pour 38 mm (1-1/2 in) below top of bond beam.
4. Pour grout using chute container with spout or pump hose. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

G. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 mm^2 (10 square inches), respectively.

2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
5. Limit grout lifts to a maximum height of 1.5 m (5 feet) and grout pour to a maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosed before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as the masonry units are laid.
10. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
11. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
12. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Contracting Officer Representative.
13. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow not less than 30 minutes, nor more than one hour between lifts of a given

- pour. Mechanically consolidate each grout lift during pouring operation.
14. Place grout in lintels or beams over openings in one continuous pour.
 15. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
 16. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.14 CLEANING AND REPAIR

A. General:

1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.
3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Concrete Masonry Units:

1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies structural steel shown and classified by Section 2, Code of Standard Practice for Steel Buildings and Bridges.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Painting: Section 09 91 00, PAINTING.
- C. Steel Decking: Section 05 31 00, STEEL DECKING.
- D. Composite Steel Deck: Section 05 36 00, COMPOSITE METAL DECKING.
- E. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.

1.3 QUALITY ASSURANCE:

- A. Fabricator and erector shall maintain a program of quality assurance in conformance with Section 8, Code of Standard Practice for Steel Buildings and Bridges. Work shall be fabricated in an AISC certified Category Std fabrication plant.
- B. Before authorizing the commencement of steel erection, the controlling contractor shall ensure that the steel erector is provided with the written notification required by 29 CFR 1926.752. Provide copy of this notification to the COR.

1.4 TOLERANCES:

Fabrication tolerances for structural steel shall be held within limits established by ASTM A6, by AISC 303, Sections 6 and 7, Code of Standard Practice for Buildings and Bridges, except as follows:

- A. Elevation tolerance for closure plates at the building perimeter and at slab openings prior to concrete placement is 6 mm (1/4 inch).

1.5 DESIGN:

- A. Connections: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with the details shown on the Drawings, supplementing where necessary. The details shown on the Drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and

the members. Promptly notify the COR of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the COR. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

1.6 REGULATORY REQUIREMENTS:

- A. AISC 360: Specification for Structural Steel Buildings
- B. AISC 303: Code of Standard Practice for Steel Buildings and Bridges.

1.7 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete
- C. Certificates:
 - 1. Structural steel.
 - 2. Steel for all connections.
 - 3. Welding materials.
 - 4. Shop coat primer paint.
- D. Test Reports:
 - 1. Welders' qualifying tests.
- E. Design Calculations and Drawings:
 - 1. Connection calculations, if required.
- F. Record Surveys.

1.8 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Institute of Steel Construction (AISC):
 - 1. AISC 360-10 Specification for Structural Steel Buildings
 - 3. AISC 303-10 Code of Standard Practice for Steel Buildings and Bridges
- C. American National Standards Institute (ANSI):
 - B18.22.1-65(R2008).....Plain Washers
 - B18.22M-81(R2000).....Metric Plain Washers
- D. American Society for Testing and Materials (ASTM):
 - A6/A6M-11.....Standard Specification for General Requirements
for Rolled Structural Steel Bars, Plates,
Shapes, and Sheet Piling

- A36/A36M-08.....Standard Specification for Carbon Structural Steel
- A53/A53M-10.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
- A123/A123M-09.....Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- A242/A242M-04(R2009)....Standard Specification for High-Strength Low-Alloy Structural Steel
- A283/A283M-03(R2007)....Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
- A307-10.....Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- A490-12.....Standard Specification for Heat-Treated Steel Structural Bolts 150 ksi Minimum Tensile Strength
- A500/A500M-10a.....Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- A501-07.....Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- A572/A572M-07.....Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
- A992/A992M-11.....Standard Specification for Structural Steel Shapes
- E. American Welding Society (AWS):
- D1.1/D1.1M-10.....Structural Welding Code-Steel
- F. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
- Specification for Structural Joints Using ASTM A325 or A490 Bolts
- G. Military Specifications (Mil. Spec.):
- MIL-P-21035.....Paint, High Zinc Dust Content, Galvanizing, Repair
- H. Occupational Safety and Health Administration (OSHA):
- 29 CFR Part 1926-2001...Safety Standards for Steel Erection

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Structural Steel: ASTM A36, A242, A283, A572, Grade 50 A992.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53, Grade B.
- E. Bolts, Nuts and Washers:
 - 1. High-strength bolts, including nuts and washers: ASTM A325 or A490.
 - 2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
 - 3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ANSI Standard B18.22.1.
- F. Zinc Coating: ASTM A123.
- G. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035.

PART 3 - EXECUTION

3.1 CONNECTIONS (SHOP AND FIELD):

- A. Welding: Welding in accordance with AWS D1.1. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
- B. High-Strength Bolts: High-strength bolts tightened to a bolt tension not less than 70% of their minimum tensile strength. Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

3.2 FABRICATION:

Fabrication in accordance with Chapter M, AISC 360. .

3.3 SHOP PAINTING:

- A. General: Shop paint steel with primer in accordance with AISC 303, Section 6.
- B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.
- C. Do not apply paint to following:
 - 1. Surfaces within 50 mm (2 inches) of joints to be welded in field.
 - 2. Surfaces which will be encased in concrete.
 - 3. Surfaces which will receive sprayed on fireproofing.
 - 4. Top flange of members which will have shear connector studs applied.

- D. Zinc Coated (Hot Dip Galvanized) per ASTM A123 (after fabrication):
Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

3.4 ERECTION:

- A. General: Erection in accordance with AISC 303, Section 7B. Temporary Supports: Temporary support of structural steel frames during erection in accordance with AISC 303, Section 7

3.5 FIELD PAINTING:

- A. After erection, touch-up steel surfaces specified to be shop painted. After welding is completed, clean and prime areas not painted due to field welding.
- B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

3.6 SURVEY:

Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that shall be supported, attached, or applied to the structural steel work, submit a certified report of survey to COR for approval. Reports shall be prepared by Registered Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS. Report shall specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

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SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies material and services required for installation of steel decking as shown and specified.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Finish Painting: Section 09 91 00, PAINTING.

1.3 DESIGN REQUIREMENTS:

- A. Design steel decking in accordance with AISI publication, "Specification for the Design of Cold-formed Steel Structural Members" except as otherwise shown or specified.
- B. Design all elements with the latest published version of applicable codes.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and similar information necessary for completing installation as shown and specified, including supplementary framing, sump pans, ridge and valley plates, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics.
- D. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit".
- E. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

1.5 QUALITY ASSURANCE:

- A. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
- A36/A36M-08.....Standard Specification for Carbon Structural Steel
 - ASTM A1008/A1008M-12....Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - A653/A653M-11.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
 - C423-09a.....Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C. American Institute of Steel Construction (AISC):
- 360-10.....Specification for Structural Steel Buildings.
- D. American Iron and Steel Institute (AISI):
- S100-07.....North American Specification for the Design of Cold-Formed Steel Structural Members, 2007 Edition with Supplement 2.aisc
- E. American Welding Society (AWS):
- D1.3-08.....Structural Welding Code - Sheet Steel
- F. Factory Mutual (FM Global):
- 1. Loss Prevention Data Sheet 1-28: Wind Loads to Roof Systems and Roof Deck Securement
 - 2. Factory Mutual Research Approval Guide (2002)
- G. Military Specifications (Mil. Spec.)

MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing
Repair

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Steel Decking: ASTM A653, Structural Quality.
- B. Galvanizing: ASTM A653, G90.
- C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- D. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats). When finish painting of steel decking is specified in Section 09 91 00, PAINTING primer coating shall be compatible with specified finish painting.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E60XX minimum.
- G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, the following items:
 - 1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
 - 2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
 - 3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
 - 4. Ridge and Valley Plates: Provide 1.3 mm (18 gauge), minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 40 mm per meter (1/2 inch per foot).
 - 5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the Drawings. Fabricate cant strips from 1 mm (20 gauge) metal with a minimum 125 mm (5 inch) face width.

6. Seat Angles for Deck: Provide where a beam does not frame into a column.
7. Sump Pans for Roof Drains: Fabricated from single piece of minimum 1.9 mm (14 gauge) galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 75 mm (3 inches) wide. Recess pans not less than 38 mm (1 1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains shall be cut in the field.

2.2 REQUIREMENTS:

- A. Provide steel decking of the type, depth, gauge, and section properties as shown.
- B. Metal Form Deck - Type 1: Single pan fluted units utilized as a permanent form for reinforced concrete slabs. Comply with the depth and gauge requirements as shown on the Contract Documents.
 1. Finish: Galvanized G-60.
 2. Finish: Phosphatized, painted.
- D. Metal Roof Deck: Single pan fluted units with flat horizontal top surfaces utilized to act as a permanent support for all superimposed loads. Comply with the depth and minimum gage requirements as shown on the Contract Documents.
 1. Wide Rib (Type B) deck.
 2. Finish: Prime painted. Apply finished coat of paint to underside of deck after installation. Color as selected by Architect.
- F. Do not use steel deck for hanging supports for any type or kind of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.
- G. Steel decking units used for interstitial levels shall include an integral system.

1. System to provide a simple point of attachment for light duty hanger devices.
2. System to allow for flexibility for attaching hangers for support of suspended ceilings, electrical, plumbing, heating, or air conditioning items, weight not to exceed 50 kg/m² (10 psf).
3. System shall provide for a minimum spacing pattern of 300 mm (12 inches) on centers longitudinally and 600 mm (24 inches) on centers transversely.
4. Maximum load suspended from any hanger is 23 kg (50 pounds).
5. System consisting of fold-down type hanger tabs or lip hanger is acceptable.

PART 3 - EXECUTION

3.1 ERECTION:

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Provide steel decking in sufficient lengths to extend over 3 or more spans, except for interstitial levels.
- E. Place steel decking units at right angles to supporting members. End laps of sheets of roof deck shall be a minimum of 50 mm (2 inches) and shall occur over supports.
- F. Fastening Deck Units:
 1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.

2. Tack weld or use self-tapping No. 8 or larger machine screws at 915 mm (3 feet) o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 915 mm (3 feet) o.c., whichever is smaller.
4. Fasten roof deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. at every support, and at closer spacing where required for lateral force resistance by diaphragm action. Attach split or partial panels to the structure in every valley. In addition, secure deck to each supporting member in ribs where side laps occur. Power driven fasteners shall be used in lieu of welding for roof deck if strength equivalent to the welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.
5. Mechanically fasten side laps of adjacent roof deck units with spans greater than 1524 mm (5 feet) between supports, at intervals not exceeding 915 mm (3 feet) o.c., or midspan, whichever is closer, using self-tapping No. 8 or larger machine screws.
6. Provide any additional fastening necessary to comply with the requirements of Underwriters Laboratories and/or Factory Mutual to achieve the required ratings.
7. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 2.1 kPa (45 psf) at eave overhang and 1.4 kPa (30 psf) for other roof areas.

G. Cutting and Fitting:

1. Cut all metal deck units to proper length in the shop prior to shipping.
2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the Structural Drawings.
3. Other penetrations shown on the approved metal deck shop drawings but not shown on the Structural Drawings shall be located, cut and reinforced by the trade requiring the opening.

4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the COR. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

3.2 WELDING:

Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.3.

3.3 FIELD REPAIR:

1. Areas scarred during erection.
2. Welds shall be thoroughly cleaned and touched-up. Touch-up paint for zinc-coated units shall be zinc rich galvanizing repair paint. Touch-up paint for shop painted units of same type used for shop painting.

- - - 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. Gratings
 - 5. Loose Lintels
 - 6. Shelf Angles
 - 7. Plate Door Sill
 - 8. Safety Nosings
 - 9. Railings: (10)

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.
- D. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

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
	Wheel guards
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. Installer's Certificates:

1. Provide current welding certificate for installers.

F. Design Calculations for specified live loads including dead loads.

G. 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.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

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):
- B18.6.1-97.....Wood Screws
- B18.2.2-87(R2005).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
- A36/A36M-08.....Structural Steel
- A47-99(R2009).....Malleable Iron Castings
- A48-03(R2008).....Gray Iron Castings
- A53-10.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
Welded and Seamless

- A123-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
- A269-10.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service
- A307-10.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- A312/A312M-09.....Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- A391/A391M-07.....Grade 80 Alloy Steel Chain
- A653/A653M-10.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
- A786/A786M-09.....Rolled Steel Floor Plate
- B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- B456-03(R2009).....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- B632-08.....Aluminum-Alloy Rolled Tread Plate
- C1107-08.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- D3656-07.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
- F436-10.....Hardened Steel Washers
- F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
- F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and Studs
- F1667-11.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
 - D1.1-10.....Structural Welding Code Steel
 - D1.2-08.....Structural Welding Code Aluminum
 - D1.3-08.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
 - AMP 521-01.....Pipe Railing Manual
 - AMP 500-06.....Metal Finishes Manual
 - MBG 531-09.....Metal Bar Grating Manual
 - MBG 532-09.....Heavy Duty Metal Bar Grating Manual
- F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:
 - SP 1-04.....No. 1, Solvent Cleaning
 - SP 2-04.....No. 2, Hand Tool Cleaning

SP 3-04.....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. Railings and Handrails: 900 N (200 pounds) in any direction at any point.
- C. Floor Plates, Gratings, Covers, Trap Doors, Catwalks, and Platforms: 500 kg/m² (100 pounds per square foot).
- D. Manhole Covers: 1200 kg/m² (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. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
3. Steel and Iron: NAAMM AMP 504.
 - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
 - b. 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.

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:

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

B. For Wall Mounted Items:

1. For items supported by metal stud partitions.

2. Steel strip 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 flattened for anchorage to stud.
 5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
 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.
- C. Supports for Items at Various Conditions at Suspended Ceilings:
1. Fabricate of structural steel shapes as shown.
 2. Drill for anchor bolts of suspended item.
- D. 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.

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. 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.
- D. 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 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 m² (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.
 - 4. Use serrated bars for exterior gratings and interior gratings.
- H. 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.

2.9 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.

2.10 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.

2.11 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.

2.12 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.

2.13 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.
 - 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.

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.

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. 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.

3.3 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.

3.4 OTHER FRAMES

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

3.5 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 Trench, Stairwell 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.

3.6 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.

3.7 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.

3.8 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.

3.9 PLATE DOOR SILL

- A. Install after roofing base flashing and counter flashing work is completed.
- B. Set in sealant and bolt to curb.

3.10 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.

3.11 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:

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. 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.

3.12 STEEL COMPONENTS FOR MILLWORK ITEMS

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

3.13 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.

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- 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 05 70 00
WIRE METAL MESH

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. Wire metal mesh with aluminum "U" frame.
 - 2. Aluminum framing members, structural design and connection details.

1.3 COORDINATION

- A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for decorative metal mesh and tube frame support.
 - 1. Include plans, elevations, component details, and attachment details.
 - 2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
 - 3. Provide structural engineered design and connections of aluminum tube frame supporting the metal mesh. Include anchor points and connection details.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design
- D. Samples for Verification: For each type of exposed finish.
 - 1. Samples of welded joints showing quality of workmanship

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator and Structural Engineer.

- B. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 - 4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups for the following types of decorative metal:
 - a. Metal Mesh: Corner showing the metal mesh and metal U edge to be used and the connections.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- B. Deliver and store cast-metal products in wooden crates surrounded by enough packing material to ensure that products are not cracked or otherwise damaged.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 WIRE METAL MESH

- A. Subject to compliance with requirements, provide the following wire metal mesh and associated support system with appearance equivalent to the basis of design product:
 - 1. Type: Square wire mesh

2. Material: Metal galvanized wire, PVC Coated, White, .08" dia minimum.
3. Size: 2"x2" (or approved alternate)
4. Percent open area: >80%
5. Min Panel Size: Width 48", Length 100"
6. Color: White as selected by architect from manufacturers full range.
7. Basis of Design Manufacturer: MCNICHOLS METAL; Quality Vinylmesh™ Wire Mesh

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.3 ALUMINUM

- A. Fabricate products from alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- B. Bars and Shapes: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.
- C. Pipe and "U" Shapes: ASTM B 429/B 429M, Alloy 6063-T6.
- D. Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.
- E. Plate and Sheet: ASTM B 209 (ASTM B 209M).
- F. Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
- G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.4 STEEL AND IRON

- A. Tubing: ASTM A 500/A 500M (cold formed).
- B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M unless otherwise indicated.
- E. Steel Sheet, Cold Rolled: ASTM A 1008/A 1008M, either commercial steel or structural steel, exposed.

2.5 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 1. Aluminum Items: Aluminum fasteners.

2. Uncoated-Steel Items: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed, Type 304 stainless-steel fasteners where exposed.
 3. Galvanized-Steel Items: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
 4. Dissimilar Metals: [Type 304] [Type 316] stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.
- C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless exposed fasteners are unavoidable.
1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193].
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Brazing Rods: For copper alloys, provide type and alloy as recommended by producer of metal to be brazed and as required for color match, strength, and compatibility in fabricated items.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Low-Emitting Paints and Coatings: Paints and coatings applied to interior decorative metal items shall comply with the testing and product requirements of the California Department of Public Health's

(formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Universal Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- G. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- H. Shop Primer for Galvanized Steel: Cementitious galvanized metal primer complying with MPI#26.
- I. Epoxy Intermediate Coat for Steel: Complying with MPI#77 and compatible with primer and topcoat.
- J. Polyurethane Topcoat for Steel: Complying with MPI#72 and compatible with undercoat.
- K. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.7 FABRICATION, GENERAL

- A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- B. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
- C. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

- E. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
- F. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- G. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
- H. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- I. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.
- J. Comply with AWS for recommended practices in shop welding behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.
 - 1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 Welds: completely sanded joint, some undercutting and pinholes okay.
- K. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.9 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M.
 - 1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.
 - 2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. Preparing Galvanized Items for Shop Priming: After galvanizing, thoroughly clean decorative metal of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.
- B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.
- C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required

alterations, followed by complete refinishing, or provide new units as required.

- E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.
- F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
 - 1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.
- G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- H. Field Brazing: Comply with requirements for brazing and for finishing brazed connections in "Fabrication, General" Article. Braze connections that are not to be left as exposed joints but cannot be shop brazed because of shipping size limitations.
- I. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

- C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint in accordance with manufacturer's recommendations.
- D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.
- E. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- F. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

--END--

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 RELATED WORK:

- A. Metal Wall Panels: Section 07 40 00 ROOFING AND SIDING PANELS.
- B. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.
- C. Cement board sheathing: Section 06 16 63, CEMENTITIOUS SHEATHING.

1.3 SUBMITTALS:

- 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.

1.4 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.

1.5 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):
National Design Specification for Wood Construction
NDS-05.....Conventional Wood Frame Construction
- C. American Institute of Timber Construction (AITC):
A190.1-07.....Structural Glued Laminated Timber
- D. American Society of Mechanical Engineers (ASME):
B18.2.1-96(R2005).....Square and Hex Bolts and Screws
B18.2.2-87.....Square and Hex Nuts
B18.6.1-97.....Wood Screws

- B18.6.4-98(R2005).....Thread Forming and Thread Cutting Tapping Screws
and Metallic Drive Screws
- E. American Plywood Association (APA):
E30-07.....Engineered Wood Construction Guide
- F. American Society for Testing And Materials (ASTM):
A47-99(R2009).....Ferritic Malleable Iron Castings
A48-03(R2008).....Gray Iron Castings
A653/A653M-10.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-
Iron Alloy Coated (Galvannealed) by the Hot Dip
Process
C954-10.....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
C1002-07.....Steel Self-Piercing Tapping Screws for the
Application of Gypsum Panel Products or Metal
Plaster Bases to Wood Studs or Metal Studs
D143-09.....Small Clear Specimens of Timber, Method of
Testing
D1760-01.....Pressure Treatment of Timber Products
D2559-10.....Adhesives for Structural Laminated Wood Products
for Use Under Exterior (Wet Use) Exposure
Conditions
D3498-11.....Adhesives for Field-Gluing Plywood to Lumber
Framing for Floor Systems
F844-07.....Washers, Steel, Plan (Flat) Unhardened for
General Use
F1667-08.....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. 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: Minimum extreme fiber stress in bending of 1100.
 - 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.
- C. 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.
- D. 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.
- E. 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.
- F. 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 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. 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.

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. 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.

G. Rough Bucks:

1. Install rough wood bucks at opening in masonry or concrete where wood frames or trim occur.
2. Brace and maintain bucks plumb and true until masonry has been built around them or concrete cast in place.
3. Cut rough bucks from 50 mm (2 inch) thick stock, of same width as partitions in which they occur and of width shown in exterior walls.
4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified.

H. Underlayment:

1. Where finish flooring of different thickness is used in adjoining areas, use underlayment of thickness required to bring finish flooring surfaces into same plane.
2. Apply to dry, level, securely nailed, clean, wood subfloor without any projections.
3. Fasten to subfloor as specified in ASTM F499.
4. Plywood and particle underlayment may be glue-nailed to subfloor.
5. Butt underlayment panels to a light contact with a 1 mm (1/32 inch) space between plywood or hardboard underlayment panels and walls, and approximately 9 mm (3/8 inch) between particleboard underlayment panels and walls.
6. Stagger underlayment panel end joints with respect to each other and offset joints with respect to joints in the subfloor at least 50 mm (2 inches).
7. After installation, avoid traffic on underlayment and damage to its finish surface.

I. 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.

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SECTION 07 13 52
MODIFIED BITUMINOUS SHEET WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies modified bituminous sheet material used for exterior below grade waterproofing located on the exterior of the elevator shaft walls.

1.2 MANUFACTURER'S QUALIFICATIONS:

- A. Approval by Contracting Officer is required of products and services of proposed manufacturers, and installers, and will be based upon submission by Contractor that:
1. Manufacturer regularly and presently manufactures bituminous sheet waterproofing as one of its principal products.
 2. Installer has technical qualifications, experience, trained personnel and facilities to install specified items.
 3. Manufacturer's product submitted has been in satisfactory and efficient operation on three similar installations for at least three years.
 4. Submit list of installations, include name and location of project and name of owner.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Bituminous sheet.
 2. Primer.
 3. Mastic.
 4. Protection material, temporary and permanent.
 5. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 6. Printed installation instructions for conditions specified.
- C. Certificates:
1. Indicating bituminous sheet manufacturer's approval of primer, and roof cement.
 2. Indicating bituminous sheet waterproofing manufacturer's qualifications as specified.
 3. Approval of installer by bituminous sheet manufacturers.
 4. Water test report.

- D. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to job in manufacturer's original unopened container.
B. Do not store material in areas where temperature is lower than 10 degrees C (50 degrees F,) or where prolonged temperature is above 32 degrees C (90 degrees F).

1.5 ENVIRONMENTAL REQUIREMENTS:

Ambient Surface and Material Temperature: Not less than 4 degrees C (40 degrees F), during application of waterproofing.

1.6 WARRANTY:

Warrant bituminous sheet waterproofing installation against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21.

1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by basic designation only.
B. Federal Specifications (Fed. Spec.):
UU-B-790A.....Building Paper, Vegetable Fiber: (Kraft, Water-INT AMD 1 Proof, Water Repellent and Fire Resistant)
C. American Society for Testing and Materials (ASTM):
C578-10.....Rigid Cellular Polystyrene Thermal Insulation
D41-11.....Asphalt Primer Used in Roofing, Dampproofing and Waterproofing
D2822-05.....Asphalt Roof Cement
D6380-03(R2009).....Asphalt Roll Roofing (Organic Felt)
D. American Hardboard Association (AHA):
A135.4-1995.....Basic Hardboard

PART 2 - PRODUCTS

2.1 BITUMINOUS SHEET:

- A. Cold applied waterproofing membrane composed primarily of modified bituminous material prefabricated in sheet form designed for below

grade exterior and split slab waterproofing. Sheet reinforced with fibers at manufacturer's option.

- B. Thickness of Bituminous Sheet: 1.5 mm (60 mils), plus or minus 0.13 mm (5 mils), and bonded to a 0.1 mm (4 mil) thick plastic sheet.
- C. Provide with a release sheet to prevent bonding of bituminous sheet to itself.

2.2 PRIMER AND ROOF CEMENT:

- A. Furnished by manufacturer of bituminous sheet as required for particular application in accordance with sheet manufacturer's instructions.
- B. Primer: ASTM D41.
- C. Roof Cement: ASTM D4586.

2.3 PROTECTION MATERIAL:

- A. Polystyrene: ASTM C578, Type I or VIII, 13 mm (1/2-inch) minimum thickness.
- B. Hardboard: PS-58, Service Type, 6 mm (1/4-inch) thick.
- C. Waterproofed Building Paper: Fed. Spec. UU-B-790.
- D. Roll Roofing: ASTM D6380, Class S (smooth), Type III with minimum net mass per unit area of roofing, 2495 g/m² (51 lb/100 ft²).

2.4 PATCHING COMPOUND:

A factory prepared, non-shrinking, fast setting, cementitious adhesive compound containing no ferrous metal or oxide.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Surface Condition:
 - 1. Before applying waterproofing materials, ensure concrete and masonry surfaces are fully cured, smooth, clean, dry, and free from high spots, depressions, loose and foreign particles and other deterrents to adhesion.
 - 2. Fill voids, joints, and cracks with patching compound.
- B. Concrete surfaces cured a minimum of seven days, free from release agents, concrete curing agents, and other contaminants.

3.2 APPLICATION:

- A. Priming:
 - 1. Prime concrete and masonry surfaces.
 - 2. Application method, amount of primer and condition or primer before installation of bituminous sheet as recommended by primer manufacturer.

3. Reprime when required in accordance with manufacturer's instructions.

B. Bituminous Sheet Installation:

1. Remove release sheet prior to application.
2. Lay bituminous sheet from low point to high point so that laps shed water.
3. Treat expansion, construction and control joints and evident working cracks as expansion joints. Apply bituminous sheet in double thickness over joint by first applying a strip of bituminous sheet not less than 200 mm (8 inches) wide, centered over joint.
4. Lap seams not less than 50 mm (2 inches).
5. Lay succeeding sheet with laps, and roll or press into place.
6. Repair misaligned or inadequately lapped seams in accordance with manufacturer's instructions.
7. Seal seams and terminations in accordance with sheet manufacturer's instructions.

C. Corner Treatment:

1. At inside and outside corners apply double cover using an initial strip not less than 280 mm (11 inches) wide, centered along axis of corner.
2. Cover each strip completely by the regular application of bituminous sheet.
3. Provide a fillet or cant on inside corners.
4. Form cants using patching compound
5. Do not use wood, fiber, and insulating materials for cants.

D. Projection Treatment:

1. Apply a double layer of bituminous sheet around pipes and similar projections at least 150 mm (6 inches) wide.
2. At drains, apply a bead of roof cement over a double layer of bituminous sheet under clamping rings.

3.3 PROTECTION:

- A. Protect bituminous sheet before backfill or wearing courses are placed.
- B. Install protection material and hold in place in accordance with instructions of manufacturer of waterproofing materials.
- C. Permanent Protection:
 1. Vertical Surfaces:
 - a. Install hardboard, polystyrene, or roll roofing protection material.

- b. Extend protection full height from footing to top of backfill.
- c. If graded backfill is used, use roll roofing or hardboard.
- D. Horizontal Surfaces:
 - 1. Install roll roofing protection under concrete wearing courses.
 - 2. Install roll roofing, hardboard, or polystyrene under earth backfill.
 - 3. Where no concrete wearing course occurs or when surfaces will bear heavy traffic and will not immediately be covered with a wearing course, use protection specified for vertical surfaces.
- E. Temporary Protection:

When waterproofing materials are subjected to damage by sunlight and can not be immediately protected as specified, protect waterproofing materials by waterproof building paper or suitable coating approved by manufacturer of waterproofing system used.

3.4 PATCHING:

Repair tears, punctures, air blisters, and inadequately lapped seams, in accordance with manufacturer's instructions before protection course is applied.

3.5 TESTING:

- A. Before any protection or wearing course is applied, test all horizontal applications of waterproofing with a minimum of 25 mm (1-inch) head of water above highest point and leave for 24 hours.
- B. Mark leaks and repair when waterproofing is dry.
- C. Certify, to Contracting Officer Representative, that water tests have been made and that areas tested were found watertight.

3.6 INSPECTION:

Do not cover waterproofed surfaces by other materials or backfill until work is approved by Contracting Officer Representative.

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SECTION 07 18 13
PEDESTRIAN TRAFFIC COATINGS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies a surface applied elastomeric and composition waterproofing type membrane suitable for light pedestrian traffic and recreation areas, but not intended for heavy industrial use.

1.2 RELATED WORK

- A. Plywood underlayment: Section 06 10 00, ROUGH CARPENTRY.
- B. Color and texture of finish coat: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 TEST AREA

Before start of general application, apply the elastomeric coating as specified in a representative test area. The area shall be approximately 9 m² (100 square feet). The area to be covered by the coating shall include all site conditions such as flashings bases, corners and projections through the coating. Location of test area shall be determined by the Contracting Officer Representative, and after approval, shall serve as an example for the remaining work.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data: Each material, indicating compliance with specification requirements.
- C. Samples: Each finish color on 100 by 200 mm (4 by 8 inch) substrate, layered to show each coat and finish.

1.5 WARRANTY

Warranty surfaces, where elastomeric coating has been applied, against leaks and other failures, over and above normal wear and failure of substrate, and subject to the terms of the "Warranty of Construction", FAR clause 52.246-21.

1.6 DELIVERY AND STORAGE

- A. Deliver materials to the site in original sealed containers, clearly marked with manufacturer's name and brand, and type of material.
- B. Store materials in weathertight and dry storage facility. Protect from damage from handling, weather and construction operations before,

during and after installation. Store materials at temperatures and under conditions recommended by the manufacturer.

1.7 ENVIRONMENTAL REQUIREMENTS

Do not proceed with application of materials when ambient temperature is less or greater than that recommended by the coating material manufacturer.

1.8 SAFETY REQUIREMENTS

Keep products away from heat, sparks and flame. Do not permit use of spark-producing equipment during application of flammable products or where explosive fumes are present.

1.9 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
- C794-10.....Adhesion-in-Peel of Elastomeric Joint Sealants
- D412-06.....Vulcanized Rubber and Thermoplastic Elastomers-Tension
- D2240-05(R2010).....Rubber Property - Durometer Hardness
- E96-10.....Water Vapor Transmission of Materials

PART 2 - PRODUCTS

2.1 PRIMER

Type required by the elastomeric coating manufacturer.

2.2 ELASTOMERIC BASE AND TOP COAT

Elastomeric base and top coat materials shall meet or exceed the following requirements:

Property	Test Method	Base Coat	Top Coat
Tensile Strength	ASTM D412	300 pounds per square inch	600 pounds per square inch
Elongation	ASTM D412	550 percent	200 percent
Hardness, Shore A	ASTM D2240	20	45
Peel Strength (on concrete)	ASTM C794	30 pounds, 100 percent cohesion	100 percent cohesion to base coat
Permeability	ASTM E96	12 metric perms	0.06 metric perms

2.3 AGGREGATE

Thoroughly washed, clean, medium grained sharp indigenous stone granules, graded between 1mm and 4mm in size, and having a hardness of 6.5 or greater on the Moh's scale.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Surfaces to be coated shall be clean and dry. Smooth rough spots and tool marks.
- B. Fill holes, depressions and cracks with fillers compatible with the coating material and recommended by the coating manufacturer.
- C. Subsurface imperfections that telegraph through the finish coating surface will not be accepted.

3.2 WORK COORDINATION

To provide a watertight installation, coordinate this work with flashing and drains required to be installed before the coating work begins and be completed after the coating is in place.

3.3 APPLICATION

- A. Prime all surfaces to receive elastomeric waterproofing materials as recommended by the products manufacturer.
- B. Where horizontal surfaces intersect vertical surfaces provide a sealant type fillet as recommended by the manufacturers.
- C. Apply elastomeric base coat at a rate that will ensure a dry film thickness of not less than 35 mils.
- D. Uniformly disperse aggregate topping at the rate of 0.5 Kg per m² (10 lbs/100 sq. ft.); inter-bond and vulcanize granules within the fluid elastomeric topping in accordance with manufacturer's instructions.
- E. Apply elastomeric top coat at a rate which will ensure a dry film thickness of 15 mils for the top coat and a total combined dry film thickness for the base and top coats of not less than 50 mils.
- F. Complete the base to a uniform established line as shown.

3.4 CLEANING

Remove smears of elastomeric material from other work.

3.5 PROTECTION

Protect the finished coating from traffic until the coating cures.

- - - E N D - - -

SECTION 07 18 16
VEHICULAR TRAFFIC COATINGS (DECK COATING)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Conditions of Contract for Construction and General Requirements of Division 1 of these Specifications apply to Work in this Section.

1.2 WORK INCLUDED

- A. Work of this Section shall include furnishing all labor, materials, equipment and supervision to install a deck coating system, including surface preparation and crack and joint detailing.
- B. Deck coating Installer shall be specifically responsible for providing all preparation Work and joint sealants specified in Section 07 92 00, Joint Sealants.

1.3 RELATED WORK

- A. Following Work is related to this Section:
1. Cast-in-Place Concrete, Section 03 30 00
 2. Joint Sealants, Section 07 92 00
 3. Pavement Markings, Section 32 17 23

1.4 QUALITY CONTROL

- A. General:
1. Deck coating Installer shall be approved by deck coating Manufacturer.
 2. Installer shall have a minimum of five (5) years experience in application of one of the approved deck coating systems and have experience for a project in size of 5,000 SF or greater.
 3. Installer and Manufacturer shall review slope of slabs and condition of surfaces prior to bidding.
 4. Manufacturer shall make available a qualified Manufacturer's Representative to assist the Installer and Engineer as specified herein. Representative shall be experienced in placement of deck coating systems.
- B. Testing Requirements:
1. Installer shall check deck coating wet film thickness and record test results by taking five wet film readings within a 1 SF area. Wet film thickness testing shall be completed a minimum of once per every 5,000 SF of deck coating placed or per individual section placed per day. Average film thickness shall be at or above wet film thickness equivalent of specified dry film thickness.

2. Manufacturer's Representative shall perform dry film thickness tests and record test results for base coat and total system. One set of three readings shall be taken in a single 100 SF area. Average dry film thickness shall be at or above Manufacturer's calculated average dry film thickness for total system based on specified dry film thickness plus aggregate.
 3. Manufacturer and Installer in presence of Engineer shall perform adhesive pull-off strength testing on base membrane and completed system in accordance with ASTM D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers. One set of three tests shall be taken in a single 100 SF area. This testing can be performed in conjunction with dry film thickness testing. All test results shall be greater than 100 psi.
 4. If thickness and pull-off strength testing do not meet above requirements, corrective action will be required.
 5. Test damage is to be repaired by Installer per Manufacturer's recommendations.
- C. Flood Test: Contractor shall arrange for and wet all slabs with water for purpose of detecting any defects in waterproofing which would result in leaks. Slab surfaces shall be wetted until water flows freely to drains. No finished spaces shall be insulated or ceiling installed until drainage test has been completed on the slab above and reviewed by Engineer for acceptance.
1. Potentially leaks are located by noting whether water from flood test is observed at underside of slabs or running down faces of walls. Leaking attributed to defective traffic bearing membrane shall be corrected by repairing waterproofing.

1.5 SUBMITTALS

- A. For record certification that the deck coating system is compatible with all of products in Divisions 3, 7, 9, and 32 to which it will come in contact.
- B. For review and approval a complete description of deck coating system proposed, including materials, surface preparation, and cure times, including repair materials for pitting, bug holes, popouts, and shallow scaling, and cure times and including aggregates.
- C. For review and approval Manufacturer's Spec Data Sheets of each product to be used.
- D. For record Material Safety Data Sheets of each product, solvent, or related chemicals to be used and certification that materials conform to local, state, and federal environmental and worker's safety laws and regulations.
- E. For review and approval standard color chart.
- F. For record ASTM C 957 Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with Integral Wearing Surface test results for thin deck coatings.
- G. For review and approval sample Warranty prior to application.
- H. For review and approval upon request qualifications of Manufacturer's Representative.

- I. For record results of slab moisture testing completed in accordance with ASTM D 4263 Standard Test Method for Indicating Moisture in Concrete by Plastic Sheet Method.
- J. For record dry and wet film thickness test results and adhesive testing results. Include date, weather, and other pertinent information.
- K. For record upon request written certification that Installer is approved by Manufacturer.
- L. For record upon request qualification statement of Installer stating projects, size, location, owner and contact, engineer/architect and contact for projects that deck coating system has been applied.

1.6 SAMPLES

- A. Submit for review and approval, 12 inch square samples of deck coating system representative of color, thickness, and surface texture. Samples may also be requested for chemical analysis.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Manufacturer and Installer are required to confirm that all deck coating materials used in accordance with this Section conform to local, state, and federal environmental and workers' safety laws and regulations.
 - 1. VOC content of materials shall not exceed limits per Environmental Protection Agency Natural Volatile Organic Compound Emission Standards for Architectural Coatings (40CFR59).
- B. Installer is solely responsible for fume control and shall take all necessary precautions against injury to personnel or adjacent building occupants during application. As a minimum, Installer shall take the following precautions:
 - 1. Provide and maintain barricades.
 - 2. Locate and protect building air intakes during application.
 - 3. Follow all state, federal, and local safety regulations.
 - 4. Follow all Manufacturer's safety requirements.
 - 5. Dispose empty containers immediately and properly.
 - 6. Use protective equipment.
 - 7. Ensure Work area is well vented to outside.

1.8 TRANSPORTATION AND HANDLING

- A. Deliver all materials to site in original, unopened containers, bearing following information:
 - 1. Name of product
 - 2. Name of Manufacturer
 - 3. Date of Manufacturer
 - 4. Lot or batch number
 - 5. UL Labels
- B. Store materials under cover, protected from weather, within Manufacturer's recommended temperatures ranges.

- C. Replace containers or materials showing any signs of damage with new material at no additional cost to Owner.
- D. At no time shall weight of stored material placed on a slab area exceed 30 PSF or 2,000 lbs. over 20 square inches.

1.9 WARRANTY

- A. Provide to Owner a Warranty by Installer and Manufacturer that deck coating system will be free of defects, water penetration, and chemical damage related to system design, workmanship or material deficiency, consisting of, but not limited to:
 - 1. Surface crazing of other weathering deficiency (including ultraviolet light exposure).
 - 2. Abrasion or tear failure resulting from normal traffic use.
 - 3. Tear failure resulting from new or existing cracks in substrate not exceeding 1/16 inch in width.
 - 4. Debonding from substrate or delaminating between layers.
 - 5. Defective installation.
 - 6. Debonding or damage of repair material used for filling in pitting, bug holes, popouts, and shallow scaling with concrete or deck coating material.
- B. Warranty shall provide at no charge to Owner materials and labor needed to properly repair or replace product and replace parking stripes within duration of Warranty.
- C. Vandalism, abrasive maintenance equipment, and construction traffic are not normal traffic use and are exempt from Warranty.
- D. New concrete may experience shrinkage. Installer shall provide system suitable for such application. Warranty shall cover deck coating damage due to new concrete slab cracking not exceeding 1/16 inch.

1.10 WARRANTY DURATION

- A. Bid price shall include a five (5) year Warranty commencing with date of project acceptance in accordance with General Conditions.
- B. Although completed areas of facility may be opened to traffic and parking, commencement of Warranty period will not occur prior to acceptance of entire project.
- C. A single Warranty commencement date will apply to all waterproofing.

PART 2 - PRODUCTS

2.1 DECK COATING - GENERAL

- A. Deck coating system shall be a fluid applied, waterproof, traffic bearing elastomeric membrane capable of preventing penetration of concrete by water, gasoline, oils, greases, salts, deicer chemicals, battery acids and radiator coolants.
- B. Color of deck coating shall be gray with Owner selecting shade of gray from standard color chart submittal.

- C. Material to fill in pitting, bug holes, popouts, and shallow scaling shall be in accordance with Manufacturer's written recommendations.
- D. Same Manufacturer's deck coating system shall be used throughout.
- E. Deck coating thicknesses specified herein are minimum dry film thicknesses and do not include the aggregate. Specified thicknesses may vary from Manufacturer's literature. A coat may have to be installed in more than one layer to achieve minimum thickness or on ramps a slope grade version of deck coating material shall be used. Install each coat in accordance with Manufacturer's recommended yield for required thickness.
- F. Thinner or solvent shall not be added to deck coating materials.
- G. All deck coating exposed to sunlight, including areas at perimeter of structure on lower levels, shall utilize a UV stable topcoat.

2.2 DECK COATING SYSTEM

- A. Provide a heavy duty coating system as indicated on Drawings.
- B. Approved heavy duty deck coating systems are:
 - 1. Iso-Flex 750U-HL HVT, LymTal International, Inc., Orion, MI. Primer, base coat at 25 mils, grit coat at 25 mils and top coat at 12 mils.
 - 2. Auto-Gard Double Texture, Neogard Corporation, Dallas, TX. Primer, base coat at 25 mils, grit coat at 25 mils, and top coat at 12 mils.
 - 3. Sonoguard, BASF Building Systems, Shakopee, MN. Primer, base coat at 25 mils, grit coat at 25 mils, and top coat at 12 mils.
 - 4. CCW5123-HD, Carlisle Coatings & Waterproofing, Wylie, TX. Primer, base coat at 25 mils, grit coat at 25 mils and top coat at 12 mils.
 - 5. Sikalastic 710/715, Sika Corporation, Lyndhurst, NJ. Primer, base coat at 25 mils, grit coat at 25 mils, top coat at 12 mils.
 - 6. Vulkem 350NF/345/346, Tremco, Cleveland, OH. . Primer, base coat at 25 mils, grit coat at 25 mils, top coat at 12 mils.

2.3 DECK COATING AGGREGATE

- A. Approved aggregates for medium and heavy duty deck coating systems are:
 - 1. #10 Granusil, Unimin, Ottawa, MN.
 - 2. 16-30 Fracsand, Oglebay Norton Industrial Sands, Inc., Brady, TX.
 - 3. Tl6/30, Badger Mining Corporation, Berlin, WI.
 - 4. or Approved Equivalent.
- B. Approved aggregates for extra heavy duty deck coating systems are basalt aggregate (traprock) as follows:
 - 1. Emeri-crete, Portsmouth, NH.
 - 2. Or Approved Equivalent.

PART 3 - EXECUTION

3.1 GENERAL

- A. Inspect surfaces to receive Work and report immediately in writing to Engineer as required in General Conditions any deficiencies in surface which render it unsuitable for proper execution of this Work. Do not proceed with Work until unsatisfactory conditions have been corrected in an acceptable manner in accordance with Engineer.
- B. Coordinate and verify that related Work meets following requirements:
 - 1. Concrete surfaces are finished, cleaned and prepped, and have completed required curing period.
 - 2. Previous surface treatments have been removed or are compatible with the systems to be installed.
 - 3. Systems selected for use are compatible with each other.
 - 4. All concrete repairs are completed.
 - 5. Sealant installation may occur several months prior to deck coating. Installer to repair damaged or defective sealants prior to deck coating installation.

3.2 PREPARATION

- A. Remove all oil, grease spots, and contaminates in accordance with Manufacturer's recommendations.
- B. Shotblast all concrete surfaces to receive deck coating. Shotblast equipment performance requirements are as follows:
 - 1. Equipment shall be capable of traveling at a constant speed to provide uniform profile. Speed and size of equipment and size of steel shot shall be selected to provide desired preparation without causing unnecessary damage to concrete surface.
 - 2. Equipment shall vacuum up, or otherwise retain all dirt, dust, and debris from blasting operation.
 - 3. Areas inaccessible to shotblaster (i.e. vertical surfaces, against walls, columns, stairways, etc.) are to be abrasive blasted or abraded to same performance.
 - 4. Shotblasted surface must be clean with a profile in which a minimum 1/16 inch of existing concrete surface is removed. Fine aggregates must be exposed; however, coarse aggregate must not be exposed. All laitance must be removed. Surface profile to match ICRI CSP5 in accordance with ICRI Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
 - 5. Remove debris immediately after surface preparation. Debris includes, but is not limited to, shot, aggregate and dust. Debris shall be placed in a covered dumpster or a covered area where it will not be rebroadcast by wind or weather.
- C. Metal surfaces that are to be deck coated shall be abrasive blasted to near white metal, SSPC SP10 in accordance with Steel Structures Painting Council Painting Manual. Rust inhibitive primer shall be installed in accordance with Manufacturer's recommendations within 8 hours of abrasive blasting.

- D. Rout and seal cracks greater than 15 mils in accordance with Section 07 92 00, Joint Sealants or as required by the Manufacturer. Cracks, coves, terminations and all unusual situations shall be detailed per Manufacturer's recommendations.
- E. Installer shall be responsible for repair or replacement of all materials damaged by surface preparation operations.
- F. Surfaces shall be air blown with sufficient pressure to remove excess dirt, dust and debris, and to assure that concrete is clean prior to application of deck coating.
- G. After shotblasting and abrasive blasting and prior to first coat of deck coating, pitting, bug holes, popouts, and shallow scaling shall be prepared in accordance with Manufacturer's recommendations. As a minimum, a thin epoxy mortar shall be used to fill voids.

3.3 INSTALLATION/APPLICATION

- A. Do all Work in strict accordance with Manufacturer's written instructions and specifications and as indicated herein.
- B. Do not apply deck coating materials until concrete has been air dried at temperatures at or above 40 degrees F. for at least 28 days after curing period specified in Section 03 30 00, Cast-In-Place Concrete, or as otherwise approved by Manufacturer.
- C. Concrete shall be dry prior to application of deck coating. Installer shall perform slab moisture testing in accordance with ASTM D 4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method. Testing must be performed in at least 1 location for every 10,000 SF of coating. Use of heat lamps for performing tests may be required in areas not exposed to sunlight.
- D. Air temperatures directly below and above the slab being coated must be maintained at a minimum of 50 degrees F up to 48 hours prior to coating and at 60 degrees F for a minimum of 72 hours after coating, or as required for full curing of material.
- E. All deck coating shall maintain straight edges at terminations.
- F. Surfaces to be deck coated shall be divided into areas in accordance with the Manufacturer's recommended yield for the specified thickness and for specific container size of material. Area is to be divided by keel marks, or another Engineer approved method.
- G. All sealants to be provided adequate cure time, minimum 8 hours, to be tack free prior to deck coating. All construction joints, control joints, joints at perimeter of patches, cold joints and cracks (sealed and unsealed) shall receive a detail coat, minimum of 4 inches wide. Detail coat shall be same thickness as base coat unless Manufacturer's requirements are more strict. Detail coat shall cure a minimum of 12 hours prior to base coating.
- H. Extend deck coating up vertical surfaces as indicated on Drawings.
- I. Incorporate aggregate until refusal. Aggregate until refusal will result in a surface that is tan in color. Additional aggregate may have to be added after first pass.
- J. Complete all Work under this Section before painting line stripes.

- K. If larger containers than 10 gallon pails and/or pumps are used, following items shall be performed.
 - 1. Submit three weeks before start of construction, plans and calculations indicating how system will be installed.
 - 2. No containers larger than 55 gallon drums
 - 3. All containers numbered consecutively with numbering unique to each container.
 - 4. Maximum of one pump and two power rollers/sprayers.
 - 5. Deck coating installed in one grid at a time. Quantity of material to determine one grid size shall be 27.5 gallons (1/2 maximum drum size).
 - 6. Develop method of measuring material in container or drum as it is being used, as approved by Engineer.
 - 7. If Work is phased and Manufacturer's yield is not met in accordance with this specification, then the use of pumps will be immediately discontinued, and maximum application grid size will be readjusted to correspond to 10 gallon pails.
 - 8. If after initial phase the Manufacturer's yield is consistently and uniformly met, then one more pump and two more power rollers/sprayers may be used with Engineer's approval. Each pump shall have its own operator and be used for separate grids.

3.4 DAMAGE AND REPAIRS

- A. Any necessary repairs for deck coating resulting from dry film testing are to be repaired by Installer.
- B. Pinholing of deck coating will be cause for rejection. Installer shall repair and take necessary steps to prevent pinholing to occur at no additional expense to Owner.

3.5 CLEANUP

- A. Remove all excess primer, sealant, deck coating, and masking materials from structure.

---END---

**SECTION 07 22 00
ROOF AND DECK INSULATION**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Roof and deck insulation and cover board on new construction ready to receive roofing or waterproofing membrane.
- B. Repairs and alteration work to existing roof insulation.

1.2 RELATED WORK

- A. General sustainable design documentation requirements: Section 01 81 11 SUSTAINABLE DESIGN REQUIREMENTS.
- B. Wood cants, blocking, and edge strips: Section 06 10 00, ROUGH CARPENTRY.
- C. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 72 00, ROOF ACCESSORIES.

1.3 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. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):
 - 90.1-07.....Energy Standard for Buildings Except Low-Rise Residential Buildings
- C. ASTM International (ASTM):
 - C208-08.....Cellulosic Fiber Insulating Board
 - C552-07.....Cellular Glass Thermal Insulation
 - C726-05.....Mineral Fiber Roof Insulation Board
 - C728-05.....Perlite Thermal Insulation Board
 - C1177/C1177M-08.....Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - C1278/C1278M-07.....Standard Specification for Fiber-Reinforced Gypsum Panel
 - C1289-10.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

- C1396/C1396M-09.....Standard Specification for Gypsum Board
- D41-05.....Asphalt Primer Used in Roofing, Dampproofing,
and Waterproofing
- D312-06.....Asphalt Used in Roofing
- D1970-09.....Standard Specification for Self-Adhering
Polymer Modified Bituminous Sheet Materials
Used as Steep Roofing Underlayment for Ice Dam
Protection
- D2178-04.....Asphalt Glass Felt Used in Roofing and
Waterproofing
- D2822-05.....Asphalt Roof Cement
- D4586-07.....Standard Specification for Asphalt Roof Cement,
Asbestos-Free
- E84-09.....Standard Test Method for Surface Burning
Characteristics of Building Material
- F1667-05.....Driven Fasteners: Nails, Spikes, and Staples
- D. FM Approvals: RoofNav Approved Roofing Assemblies and Products.
- 4450-89.....Approved Standard for Class 1 Insulated Steel
Deck Roofs
- 4470-10.....Approved Standard for Class 1 Roof Coverings
- 1-28-09.....Loss Prevention Data Sheet: Design Wind Loads.
- 1-29-09.....Loss Prevention Data Sheet: Above-Deck Roof
Components
- 1-49-09.....Loss Prevention Data Sheet: Perimeter Flashing
- E. National Roofing Contractors Association: Roofing and Waterproofing
Manual
- F. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog,
www.biopreferred.gov
- G. Underwriters Laboratories, Inc. (UL): Fire Resistance Directory (2009)
- H. U.S. Department of Commerce National Institute of Standards and
Technology (NIST):
- DOC PS 1-09.....U.S. Product Standard for Construction and
Industrial Plywood
- DOC PS 2-04.....Performance Standard for Wood-Based Structural-
Use Panels.

1.4 PERFORMANCE REQUIREMENTS

- A. Thermal Performance: Provide roof insulation meeting minimum overall
average R-value of 33, with minimum R-value at any location of 10.

- B. FM Approvals: Provide roof insulation complying with requirements in FM Approvals 4450 and 4470 as part of specified roofing system, listed in FM Approvals "RoofNav" as part of roofing system meeting Fire/Windstorm Classification in Division 07 roofing section.

1.5 QUALITY CONTROL

- A. Requirements of Division 07 roofing section for qualifications of roofing system insulation Installer; Work of this Section shall be performed by same Installer.
- B. Requirements of Division 07 roofing section for inspection of Work of this Section and qualifications of Inspector.
- C. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.
- D. Requirements of roofing system uplift pressure design for specified roofing system.
- E. Requirements of applicable FM Approval for specified roofing system insulation attachment.
- F. Requirements of applicable Miami-Dade County approval for high-wind zone design.
- 1.
- G. Bio-Based Materials: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
 - 1. Asphalt and adhesive materials, each type.
 - 2. Roofing cement, each type.
 - 3. Roof insulation, each type.
 - 4. Substrate board, each type.
 - 5. Cover board, each type.
 - 6. Fastening requirements.
 - 7. Insulation span data for flutes of metal decks.
- C. LEED and Federal Sustainable Design Submittals:

1. Product Data on IEQ For adhesives and sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
 - 2.
 3. Product Data for Federally-Mandated Bio-Based Materials: For roof materials, indicating USDA designation and compliance with definitions for bio-based products, Rapidly Renewable Materials, and certified sustainable wood content.
- D. Shop Drawings: Include plans, sections, details, and attachments.
1. Nailers, cants, and terminations.
 2. Layout of insulation showing slopes, tapers, penetration, and edge conditions.
- E. Samples:
1. Roof insulation, each type.
 2. Nails and fasteners, each type.
- F. Certificates:
1. Indicating type, thermal conductance, and minimum and average thickness of insulation.
 2. Indicating materials and method of application of insulation system meet the requirements of FM Approvals for specified roofing system.
- G. Laboratory Test Reports: Thermal values of insulation products.
- H. Layout of tapered roof system showing units required.
- I. Documentation of supervisors' and inspectors' qualifications.

1.7 DELIVERY, STORAGE AND MARKING

- A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to built-up roofing for storage, handling and installation requirements.

1.8 QUALITY ASSURANCE:

- A. 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 E84, or shall have successfully passed FM Approvals 4450.
1. 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.
 2. 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 particular 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 Approvals "RoofNav."

3. 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 ADHESIVE MATERIALS

- A. Adhesive Materials, General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
 1. Liquid-type adhesive materials shall comply with VOC limits of authorities having jurisdiction.
 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Multipurpose Construction Adhesives: 70 g/L.
 - c. Fiberglass Adhesives: 80 g/L.
 - d. Contact Adhesives: 80 g/L.
 - e. Other Adhesives: 250 g/L.
 - f. Nonmembrane Roof Sealants: 300 g/L.
 - g. Sealant Primers for Nonporous Substrates: 250 g/L.
 - h. Sealant Primers for Porous Substrates: 775 g/L.
- B. Primer: ASTM D41.
- C. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.
- D. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- E. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- F. Full-Spread Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component

urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

- G. Roof Cement: Asbestos free, ASTM D2822, Type I or Type II, ; or, D4586, Type I or Type II.

2.2 ROOF AND DECK INSULATION

- A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer and listed as component of FM Approvals-approved roofing system.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- F. Tapered Roof Insulation System:
1. Fabricate of mineral fiberboard, polyisocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
 2. Cut to provide high and low points with crickets and slopes as shown.
 3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).
 4. Minimum slope 1:48 (1/4 inch per 12 inches).

2.3 INSULATION ACCESSORIES

- A. Glass (Felt): ASTM D2178, Type VI, heavy duty ply sheet.
- B. Cants and Tapered Edge Strips:
1. Wood Cant Strips: Refer to Division 06 Section "Rough Carpentry."
 2. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
 3. Tapered Edge Strips: 1:12 (one inch per foot), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
 - a. Cellulosic Fiberboard: ASTM C208.
 - b. Mineral Fiberboard: ASTM C726.
 - c. Perlite Board: ASTM C728.
- E. Cover Board:
1. Glass-mat, water-resistant gypsum substrate, ASTM C1177/C1177M, 6 mm (1/4 inch) thick, factory primed.

2.4 FASTENERS

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening substrate board to roof deck.
- B. Staples and Nails: ASTM F1667. Type as designated for item anchored and for substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with requirements of Division 07 roofing section.

3.2 PREPARATION

- A. Comply with requirements of Division 07 roofing section.

3.5 RIGID INSULATION INSTALLATION

- A. Insulation Installation, General:
 - 1. Install roof insulation in accordance with roofing system manufacturer's written instructions.
 - 2. Install roof insulation in accordance with requirements of FM Approval's Listing for specified roofing system.
 - 3. Base Sheet: Where required by roofing system, install one lapped base sheet specified in Division 07 roofing section by mechanically fastening to roofing substrate prior to installation of insulation.
 - 4. Cant Strips: Install preformed insulation cant strips at junctures of roofing system with vertical construction.
- B. Insulation Thickness:
 - 1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the average thermal resistance "R" value of not less than that specified in Performance Requirements Article.
 - 2. Insulation on Metal Decks: Provide minimum thickness of insulation for metal decks recommended by the insulation manufacturer to span rib opening (flute size) of metal deck used. Support edges of insulation on metal deck ribs.
 - 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 68 mm (2.7 inch) or more in thickness unless specified otherwise. Stagger joints minimum 150 mm (6 inches).
- C. 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.
- D. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.
- E. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.
- F. Cut to fit tight against blocking or penetrations.
- G. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.
- H. Installation Method:
1. Adhered Insulation:
 - a. Prime substrate as required.
 - b. Set each layer of insulation firmly in solid mopping of hot asphalt.
 - c. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive.
 - d. Set each layer of insulation firmly in uniform application of full-spread insulation adhesive.
 2. Mechanically Fastened Insulation:
 - a. Fasten insulation in accordance with FM Approval's "RoofNav" requirement in Division 07 roofing section.
 - b. Fasten insulation to resist uplift pressures specified in Division 07 roofing section.
 3. Mechanically Fastened and Adhered Insulation:
 - a. Fasten first layer of insulation according to "Mechanically Fastened Insulation" requirements.
 - b. Fasten each subsequent layer of insulation according to "Adhered Insulation" requirements.
 4. Cover Board: Install cover boards over insulation with long joints in continuous straight lines with staggered end joints. Offset cover board joints from insulation joints minimum 150 mm (6 inches).

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Fasten cover boards according to "Adhered Insulation" "Mechanically
Fastened Insulation" requirements.

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**SECTION 07 40 00
ROOFING AND SIDING PANELS**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies uninsulated metal wall panels as shown.

1.2 RELATED WORK

- A. Sealant: Section 07 92 00, JOINT SEALANTS.
- B. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 MANUFACTURER'S QUALIFICATIONS

Metal wall panels shall be products of a manufacturer regularly engaged in the fabrication and erection of metal panels of the type and design shown and specified.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Metal panel, 150 mm (six inch) square, showing finish, each color and texture.
- C. Shop Drawings: Wall and roof panels, showing details of construction and installation, thickness and kind of material, closures, flashing, fastenings and related components and accessories.
- D. Manufacturer's Literature and Data: Wall and roof panels

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 Materials (ASTM):
 - A653/A653M-10 Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - A463-10 Steel Sheet, Cold-Rolled, Aluminum-Coated, by the Hot-Dip Process
 - A924/A924M-10 Steel Sheet, Metallic Coated by the Hot-Dip Process
 - A1008/A1008M-10 Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy
 - B209/209M-07 Aluminum and Aluminum Alloy Sheet and Plate
 - C1396-11 Standard Specification for Gypsum Board
 - C553-08 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

- C591-09..... Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation
- C612-10..... Mineral Fiber Block and Board Thermal
Insulation
- E119-10..... Fire Test of Building Construction and
Materials

PART 2 - PRODUCTS

A. Provide metal wall panel equivalent to the following basis of design product:

1. Berridge "L-Panel" metal wall panel; 24 gage; smooth profile with no grooves; color Zinc-Cote.

2.1 SHEET STEEL

- A. Minimum 24 gage for wall and roof panels.
- B. Steel, Sheet, Galvanized: ASTM A653/A653M, Structural.
1. Grade 40, galvanized coating conforming to ASTM A924/A924M, Class Z 275 G-90.
- C. Steel, Sheet, Commercial: ASTM A1008, Type C.

2.2 ALUMINUM PLATE AND SHEET

ASTM B209/209M

2.3 FASTENERS

Fasteners for steel panels shall be galvanized or cadmium plated steel.
Fasteners for aluminum panels shall be aluminum or stainless steel.

FASTENERS OF SIZE, TYPE AND HOLDING STRENGTH AS RECOMMENDED BY MANUFACTURER.2.4 GYPSUM BACKING BOARD

- A. GLASS MAT SHEALTHING 5/8" thick, Plain face, Square edge.

2.5 UNDERLAYMENT

- A. Use water barrier wrap as underlayment over gypsum backing board.
Ensure wrap provides a continuous water barrier.

2.6 FABRICATION

- A. Metal wall panels shall be uninsulated single sheets, formed to be approximate overall 11 5/8" wide by 1" deep and in the configuration shown on drawings. Connection between panels shall be by interlocking. Furnish wall panels in one continuous length for full height or at least one story height with no horizontal joints, except at openings. Construct panels as follows:
1. Wall panels:
 - a. 080 thick aluminum-zink alloy coated steel sheet, painted, bent to form 1 1/4" thick aluminum panels, with 5/8" wide reveals, sized as indicated on drawings.

3. Accessories and flashing shall be the same material as the panels. Thickness and installation of accessories and flashing shall be as recommended by the panel manufacturer.

2.7 FINISH

- A. For uninsulated wall panels, the finishes shall be as follows for aluminumized steel sheets:
 1. Finish shall be full strength Kynar 500® or Hylar 5000™ fluoropolymer coating applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of min 0.75 mil over min 0.20 mil prime coat, to provide a total top side dry film thickness of min 0.95 mil. Bottom side shall be coated with a primer and urethane coating with a total dry film thickness of min 0.35mil. Colors shall be selected from the manufacturer's full range of colors.
- B. Aluminum alloy used for color coating shall be as required to produce specified color. Color shall be as specified in Section 09 06 00, SCHEDULE FOR FINISHES. Color for sheet aluminum shall not deviate more than the colors of extrusion samples.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install panels in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise. Panels shall be in full and firm contact with supports and with each other at side and end laps. Where panels are cut in the field, or where any of the factory applied coverings or coatings are abraded or damaged in handling or installation, they shall, after the necessary repairs have been made with material of the same type and color as the weather coating, be approved before being installed. All cut ends and edges, including those at openings through the sheets shall be sealed completely. Correct defects or errors in the materials in an approved manner. Replace materials which cannot be corrected in an approved manner with nondefective material. Provide molded closure strips where indicated and whenever sheets terminate with open ends after installation.
- B. Wall Panels: Apply panels with the configuration in a vertical position. Provide panels in the longest obtainable lengths, with end laps occurring only at structural members full heights from base to eave with no horizontal joints except at the junctions of door frames, window frames, louver panels, and similar locations. Seal side and end

laps with joint sealing material. Flash and seal walls at the base, at the top, around windows, door frames, framed louvers, and other similar openings. Install closure strips, flashings, and sealing material in an approved manner that will assure complete weather tightness. Flashing will not be required where approved "self-flashing" panels are used.

- C. Flashing: All flashing and related closures and accessories in connection with the preformed metal panels shall be provided as indicated and as necessary to provide a watertight installation. Details of installation, which are not indicated, shall be in accordance with the panel manufacturer's printed instruction and details, or the approved shop drawings. Installation shall allow for expansion and contraction of flashing.
- D. Fasteners: Fastener spacings shall be in accordance with the manufacturer's recommendations, and as necessary to withstand the design loads indicated. Install fasteners in valleys or crowns as recommended by the manufacturer of the sheet being used. Install fasteners in straight lines within a tolerance of 13 mm (1/2-inch) in the length of a bay. Drive exposed penetrating type fasteners normal to the surface, and to a uniform depth to seat gasketed washers properly, and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered in valleys, or crowns, as applicable. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners shall not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels. Remove metal shavings and filings from roofs on completion to prevent rusting and discoloration of the panels.

3.2 ISOLATION OF ALUMINUM

- A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze, or other metal compatible with aluminum by one of the following:
1. Painting the dissimilar metal with a prime coat of Zinc-Molybdate followed by two coats of aluminum paint.
 2. Placing a non-abrasive tape or gasket between the aluminum and the dissimilar metal.
- B. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of alkali-resistant bituminous paint.

- C. Paint aluminum in contact with wood or other absorptive materials, that may become repeatedly wet, with two coats of bituminous paint, or two coats of aluminum paint. Seal joints with caulking material.

3.3 PROTECTION AND CLEANING

- A. Protect panels and other components from damage during and after erection, and until project is accepted by the Government.
- B. After completion of work, all exposed finished surfaces of panels shall be cleaned of soil, discoloration and disfiguration. Touch-up abraded surfaces of panels.

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SECTION 07 54 23
THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Thermoplastic Polyolefin (TPO) sheet roofing adhered/ to roof deck.

1.2 RELATED WORK

- A. General sustainable design documentation requirements: Section 01 81 13
SUSTAINABLE DESIGN REQUIREMENTS.
- B. Treated wood framing, blocking, and nailers: Section 06 10 00, ROUGH
CARPENTRY
- C. Roof Insulation: Section 07 22 00, ROOF AND DECK INSULATION.
- D. Sheet metal components and wind uplift requirements for roof-edge
design: Section 07 60 00, FLASHING AND SHEET METAL.
- E. Roof hatches, equipment supports, dome type skylights, and gravity
ventilators: Section 07 72 00, ROOF ACCESSORIES
- F. Miscellaneous items: Section 07 71 00, ROOF SPECIALTIES/ Section 07 72
00, ROOF ACCESSORIES.

1.3 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. Editions of applicable publications current on date of
issue of bidding documents apply unless otherwise indicated.
- B. American National Standards Institute/Single-Ply Roofing Institute
(ANSI/SPRI):
ANSI/SPRI ES-1-03.....Wind Design Standard for Edge Systems Used with
Low Slope Roofing Systems.
- C. American Society of Civil Engineers/Structural Engineering Institute
(ASCE/SEI):
ASCE/SEI-7-10.....Minimum Design Loads for Buildings and Other
Structures
- D. ASTM International (ASTM):
C67-09.....Standard Test Methods for Sampling and Testing
Brick and Structural Clay Tile
C140-09.....Standard Test Methods for Sampling and Testing
Concrete Masonry Units and Related Units

- C1371-04.....Standard Test Method for Determination of
Emittance of Materials Near Room Temperature
Using Portable Emissometers
- C1549-04.....Standard Test Method for Determination of Solar
Reflectance Near Ambient Temperature Using a
Portable Solar Reflectometer
- D4263.....Standard Test Method for Indicating Moisture in
Concrete by the Plastic Sheet Method
- D4434-06.....Standard Specification for Poly (Vinyl Chloride)
Sheet Roofing
- D6878-08.....Standard Specification for Thermoplastic
Polyolefin Based Sheet Roofing
- E108-10.....Standard Test Methods for Fire Tests of Roof
Coverings
- E408-71(R2008).....Standard Test Methods for Total Normal Emittance
of Surfaces Using Inspection-Meter Techniques
- E1918-06.....Standard Test Method for Measuring Solar
Reflectance of Horizontal and Low-Sloped
Surfaces in the Field
- E1980-01.....Standard Test Method for Measuring Solar
Reflectance of Horizontal and Low-Sloped
Surfaces in the Field
- E. American Society of Heating, Refrigeration, and Air Conditioning
Engineers (ASHRAE)
ASHRAE 90.1-2007.....Energy Standard for Buildings Except Low-Rise
Residential Buildings, Appendix f.
- F. Cool Roof Rating Council:
CRRC-1.....Product Rating Program, www.coolroofs.org
- G. FM Approvals: RoofNav Approved Roofing Assemblies and Products.
4450-89.....Approved Standard for Class 1 Insulated Steel
Deck Roofs
- 4470-10.....Approved Standard for Class 1 Roof Coverings
- 1-28-09.....Loss Prevention Data Sheet: Design Wind Loads.
- 1-29-09.....Loss Prevention Data Sheet: Above-Deck Roof
Components
- 1-49-09.....Loss Prevention Data Sheet: Perimeter Flashing
- H. National Roofing Contractors Association: Roofing and Waterproofing
Manual
- I. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog,
www.biopreferred.gov

J. U.S. Department of Energy (DoE): Roof Products Qualified Product List,
www.energystar.gov

1.4 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- B. Roofing System Energy Performance Requirements: Provide a roofing system identical to components that that have been successfully tested by a qualified independent testing and inspecting agency to meet the following requirements:
 - 1. C. Energy Performance, Energy Star: Provide roofing system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980 based on testing identical products by a qualified testing agency.
 - 2. Energy Performance, Aged: Provide roofing system with minimum three-year aged solar reflectance not less than 0.55 when tested in accordance with ASTM C1549 or ASTM E1918, and in addition, a minimum three-year-aged thermal admittance of 0.75 when tested in accordance with ASTM C1371 or ASTM E408.
 - a. Where tested aged values are not available for proposed product, submit calculations to adjust initial solar reflectance to demonstrate compliance as indicated in ASHRAE 90.1-2007 Addendum f.
 - b. Alternatively, provide roofing system with minimum three-year aged Solar Reflectance Index of not less than 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft² (12 W/m²K).

1.5 QUALITY CONTROL

- A. Installer Qualifications:
 - 1. Licensed or approved in writing by manufacturer to perform work under warranty requirements of this Section.
 - 2. Employ full-time supervisors knowledgeable and experienced in roofing of similar types and scopes, and able to communicate with owner and workers.
- B. Inspector Qualifications: Inspection of work by third-party technical inspector or technical representative of manufacturer experienced in the

installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer not engaged in the sale of products.
2. An independent party certified as a Registered Roof Observer by the Roof Consultants Institute (RCI), retained by the Contractor or the Manufacturer and approved by the Manufacturer.

C. Product/Material Requirements:

1. Obtain products from single manufacturer or from sources recommended by manufacturer for use with roofing system and incorporated in manufacturer's warranty.
2. Bio-Based Materials: For Products designated by the USDA's Bio Preferred program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred program, visit <http://www.biopreferred.gov>

D. Roofing system design standard requirements:

1. Recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to modified bituminous sheet roofing for storage, handling and application.
2. Recommendations of FM Approvals 1-49 Loss Prevention Data Sheet for Perimeter Flashings.
3. Recommendations of ANSI/SPRI ES-1 for roof edge design.
4. FM Approvals Listing: Provide roofing membrane, base flashing, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a roofing system and that are listed in FM Approvals "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - a. Fire/Windstorm Classification: Class 1A-90.
 - b. Hail Resistance: MH.

E. Pre-Roofing Meeting:

1. Upon completion of roof deck installation and prior to any roofing application, hold a pre-roofing meeting arranged by the Contractor

- and attended by the Roofing Inspector, Material Manufacturers Technical Representative, Roofing Applicator, Contractor, and Contracting Officer Representative.
2. Discuss specific expectations and responsibilities, construction procedures, specification requirements, application, environmental conditions, job and surface readiness, material storage, and protection.
 3. Inspect roof deck at this time to:
 - a. Verify that work of other trades which penetrates roof deck is completed.
 - b. Determine adequacy of deck anchorage, presence of foreign material, moisture and unlevel surfaces, or other conditions that would prevent application of roofing system from commencing or cause a roof failure.
 - c. Examine samples and installation instructions of manufacturer.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data:
 1. Adhesive materials.
 2. Membrane sheet roofing and flashing membrane.
 3. Roofing cement.
 4. Roof walkway.
 5. Fastening requirements.
 6. Application instructions.
- C. Federal Sustainable Design Submittals:
 1. Product Test Reports: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
 2. Product Data for Federally-Mandated Bio-Based Materials: For roof materials, indicating USDA designation and compliance with definitions for bio-based products, Rapidly Renewable Materials, and certified sustainable wood content.
- D. Samples:
 1. Nails and fasteners, each type.
- E. Shop Drawings: Include plans, sections, details, and attachments.
 1. Base flashings and terminations.
- F. Certificates:

1. Indicating materials and method of application of roofing system meets requirements of FM Approvals "RoofNav" for specified fire/windstorm classification.

K. Contract Close-out Submittals:

1. Maintenance Manuals.
2. Warranty signed by installer and manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to single ply membrane roofing for storage, handling and installation.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Environmental Controls: Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- C. Protection of interior spaces: Refer to Section 01 00 00, GENERAL REQUIREMENTS.

1.9 WARRANTY

Roofing work subject to the terms of the Article "Warranty of Construction," FAR clause 52.246-21, except extend the warranty period to 10 years.

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING

- A. TPO Sheet: ASTM D6878, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, with no backing.
 1. Color: White.

2.2 ACCESSORIES:

- A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.
- B. Bonding Adhesive: Manufacturer's standard, water based.

- C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 25 by 3 mm (1 by 1/8 inch) thick; with anchors.
- D. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 25 mm wide by 1.3 mm (1 inch wide by 0.05 inch) thick, prepunched.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening membrane to substrate.
- F. Miscellaneous Accessories: Provide sealers, preformed flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories acceptable to manufacturer.

2.3 ADHESIVE AND SEALANT MATERIALS:

- A. General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine substrates and conditions with roofing Installer and roofing inspector to verify compliance with project requirements and suitability to accept subsequent roofing work. Correct unsatisfactory conditions before proceeding with roofing work.
- B. Do not apply roofing if roof surface will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless system is protected.

3.2 PREPARATION

- A. Complete roof deck construction prior to commencing roofing work:
 - 1. Install curbs, blocking, edge strips, nailers, cants, and other components where insulation, roofing, and base flashing is attached to, in place ready to receive insulation and roofing.
 - 2. Complete deck and insulation to provide designed drainage to working roof drains.
 - 3. Document installation of related materials to be concealed prior to installing roofing work.

- B. 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 to dry substrates.
- C. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- D. Remove projections that might damage materials.
- E. Concrete Decks, except Insulating Concrete:
 - 1. Test concrete decks for moisture prior to application of roofing materials. Test for capillary moisture by plastic sheet method according to ASTM D4263.
 - 2. Prime concrete decks, including precast units, with primer as specified. Keep primer back four inches from joints in precast units.
 - 3. Allow primer to dry before application of adhesive.
- F. Insulating Concrete Decks:
 - 1. Allow to dry out for at least five days after installation before the placement of materials.
 - 2. If rain occurs during or at end of drying period or during installation of roofing, allow additional drying time before the placement of the roofing materials.
- G. Poured Gypsum Decks: Dry out poured gypsum in accordance with manufacturer's printed instructions prior to application of roofing materials.
- H. Existing Membrane Roofs and Repair Areas:
 - 1. Comply with requirements in Section 07 01 50.19 PREPARATION FOR REROOFING.
 - 2. At areas to be altered or repaired, remove loose, damaged, or cut sheet that is not firmly adhered only where new penetrations occur or repairs are required.
 - 3. Cut and remove existing roof membrane for new work to be installed. Clean cut edges and install a temporary seal to cut surfaces. Use roof cement and one layer of 7 Kg (15 pound) felt strip cut to extend 150 mm (6 inches) on each side of cut surface. Bed strip in roof cement and cover strip with roof cement to completely embed the felt.
 - 4. At modified bituminous base flashing to be repaired, either bend up cap flashing or temporarily remove cap flashing. Brush and scrape away all deteriorated sheets or surface material of base flashing.

3.3 TEMPORARY PROTECTION

- A. Install temporary protection at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent. Comply with approved temporary protection plan.

- B. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
- C. Provide for removal of water or drainage of water away from the work.
- D. Provide temporary protection over installed roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by Contracting Officer Representative, for roof areas that are to remain intact, and that are subject to foot traffic and damage. Provide notches in sleepers to permit free drainage.

3.4 INSTALLATION, GENERAL

- A. FM Approvals Installation Standard: Install roofing membrane, base flashings, wood cants, blocking, curbs, and nailers, and component materials in compliance with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system as listed in FM Approval's "RoofNav" for fire/windstorm classification indicated. Comply with recommendations in FM Approvals' Loss Prevention Data Sheet 1-49, including requirements for wood nailers and cants.
- B. NRCA Installation Standard: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations.
- C. Manufacturer Recommendations: Comply with roofing system manufacturer's written installation recommendations.
- D. Coordination with related work: Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.
- E. Installation Conditions:
 - 1. Apply dry roofing materials. Apply roofing work over dry substrates and materials.
 - 2. Apply materials within temperature range and surface and ambient conditions recommended by manufacturer.
 - 3. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
 - a. Do not apply materials when the temperature is below 4 deg. C (40 deg. F).
 - b. Do not apply materials to substrate having temperature of 4 deg. C (40 deg. F) or less.

3.5 INSTALLATION OF TPO ROOFING

- A. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances which are not compatible with TPO.
- B. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.
- C. Commence installation at the low point of the roof and work towards the high point. Lap the sheets so the flow of water is not against the edges of the sheet.
- D. Position the membrane so it is free of buckles and wrinkles.
- E. Roll sheet out on deck; inspect for defects as being rolled out and remove defective areas. Allow for relaxing before proceeding.
 - 1. Lap edges and ends of sheets 50 mm (two inches) or more as recommended by the manufacturer.
 - 2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434.
 - 3. Check seams to ensure continuous adhesion and correct defects.
 - 4. Finish edges of laps with a continuous beveled bead of sealant to sheet edges to provide smooth transition.
 - 5. Finish seams as the membrane is being installed (same day).
 - 6. Anchor perimeter to deck or wall as specified.
- F. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
- G. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (four-inches) beyond cut.
- H. Membrane Perimeter Anchorage:
 - 1. Install metal fastening strip at the perimeter of each roof level, curb flashing, expansion joints and similar penetrations as indicated and in accordance with membrane manufacturer's instructions on top of roof membrane to deck or wall.
 - 2. Mechanically Fastened Metal Fastening Strip:
 - a. Set top of mechanical fastener set flush with top surface of the metal fastening strip. Space mechanical fasteners a maximum 300 mm (12 inches) on center starting 25 mm (one inch) from the end of the nailing strip.
 - b. When strips are cut round corners and eliminate sharp corners.
 - c. After mechanically fastening strip cover and seal strip with a six-inch wide roof membrane strip; heat weld to roof membrane and seal edges.

- d. At roof edge metal, turn the membrane down over the front edge of the blocking or the nailer to below blocking. Secure the membrane to the vertical portion of the nailer; or, if required by the membrane manufacturer with fasteners spaced not over 300 mm (12 inches) on centers.
 - e. At parapet walls, intersecting building walls and curbs, secure the membrane to the structural deck with fasteners 300 mm (12 inches) on centers or as shown on NRCA manual.
- I. Adhered System:
1. Apply adhesive in quantities required by roof membrane manufacturer.
 2. Fold sheet back on itself after rolling out and coat the bottom side of the membrane and the top of the deck with adhesive. Do not coat the lap joint area.
 3. After adhesive has set according to adhesive manufacturer's application instruction, roll the membrane into the adhesive in a manner that minimizes voids and wrinkles.
 4. Repeat for other half of sheet. Cut voids and wrinkles to lay flat and clean for repair patch over cut area.

3.6 INSTALLATION OF FLASHING

- A. Install flashings as the membrane is being installed. If the flashing can not be completely installed in one day, complete the installation until the flashing is in a watertight condition and provide temporary covers or seals.
- B. Flashing Roof Drains:
1. Install roof drain flashing as recommended by the membrane manufacturer, generally as follows:
 - a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
 - b. Do not allow the roof cement to come in contact with the TPO roof membrane.
 - c. Adhere the TPO roof membrane to the metal flashing with the membrane manufacturer's recommended adhesive.
 2. Turn down the metal drain flashing and TPO roof membrane into the drain body and install clamping ring and strainer.
- C. Installing TPO Base Flashing and Pipe Flashing:
1. Install TPO flashing membranes to pipes, wall or curbs to a height not less than eight-inches above roof surfaces and 100 mm (four inches) on roof membrane.

- a. Adhere flashing to pipe, wall or curb with adhesive.
 - b. Form inside and outside corners of TPO flashing membrane in accordance with NRCA manual. Form pipe flashing in accordance with NRCA manual use pipe boot.
 - c. Lap ends not less than 100 mm (four inches).
 - d. Heat weld flashing membranes together and flashing membranes to roof membranes. Finish exposed edges with sealant as specified.
 - e. Install flashing membranes in accordance with NRCA manual.
2. Anchor top of flashing to walls or curbs with fasteners spaced not over 200 mm (eight inches) on centers. Use fastening strip on ducts. Use pipe clamps on pipes or other round penetrations.
 3. Apply sealant to top edge of flashing.
- D. Installing Building Expansion Joints:
1. Install base flashing on curbs as specified.
 2. Coordinate installation with metal expansion joint cover or roof expansion joint system.
 2. Install flexible tubing 1-1/2 times width of joint over joint. Cover tubing with TPO flashing strip adhered to base flashing and lapping base flashing 100 mm (four inches). Finish edges of laps with sealants as specified.
- E. Repairs to membrane and flashings:
1. Remove sections of TPO sheet roofing or flashing that is creased wrinkled or fishmouthed.
 2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (four inches) beyond damaged, cut, or removed area. Heat weld to roof membrane or flashing. Finish edge of lap with sealant as specified.

3.7 FIELD QUALITY CONTROL:

- A. Roofing Inspector: Contractor shall engage a qualified roofing inspector for a minimum of 5 full-time days on site to perform roof tests and inspections and to prepare start up, interim, and final reports.
1. Examine and probe seams in the membrane and flashing in the presence of Contracting Officer Representative and Membrane Manufacturer's Inspector.
 2. Probe edge of welded seams with a blunt tipped instrument. Use sufficient hand pressure to detect marginal welds, voids, skips, and fishmouths.

- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing work where test results or inspections indicate that they do not comply with specified requirements.
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.8 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of acceptance by Owner.
- C. Clean overspray and spillage from adjacent construction. Clean membrane and restore surface to like-new condition meeting solar reflectance requirements.

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies copings, gravel stops, and fascias.

1.2 RELATED WORK

- A. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES
- B. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- C. General insulation: Section 07 21 13, THERMAL INSULATION
- D. 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-08.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

C612-10.....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 500-06.....Metal Finishes Manual

D. American Architectural Manufacturers Association (AAMA):
2605-11.....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: Anodized .

2.3 EXTRUDED ALUMINUM 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 in manufacturer's standard sizes.
- G. Factory fabricated fascia sump assemblies.
 - 1. Fabricate sump assemblies with stainless steel cores and extruded aluminum cover to match fascia-cant.
 - 2. Provide stainless steel outlet, tube sized to suit downspout and solder to core to make watertight.
 - 3. Furnish sump assembly in 500 mm (20 inch) minimum lengths.
- H. 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: anodized.

2.5 FINISH

- A. In accordance with NAAMM Amp 500-505.
- B. Aluminum, Mill Finish: AA-MIX, as fabricated.
- C. Aluminum, Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1, Architectural, 0.7 mils thick. .

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.

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.
- C. Firststop Systems to be HILTI. Reference specification section 01 00 00.

1.2 RELATED WORK

- A. Expansion and seismic joint firestopping: Section 07 95 13, EXPANSION JOINT COVER ASSEMBLIES.
- B. Spray applied fireproofing: Section 07 81 00, APPLIED FIREPROOFING
- C. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- D. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS.

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.

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):
 - E84-10.....Surface Burning Characteristics of Building Materials
 - E814-11.....Fire Tests of Through-Penetration Fire Stops
- C. Factory Mutual Engineering and Research Corporation (FM):
 - Annual Issue Approval Guide Building Materials
- D. Underwriters Laboratories, Inc. (UL):
 - Annual Issue Building Materials Directory
 - Annual Issue Fire Resistance Directory
 - 1479-10.....Fire Tests of Through-Penetration Firestops
- E. Warnock Hersey (WH):
 - Annual Issue Certification Listings

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

- A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m² (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.
- J. Firestop Selection Chart attached at end of this specification section.
- K. Engineering Judgement s- For situations where custom drawings for firestopping assemblies are required to accommodate particular conditions/applications not identified in the HILTI Firestop Systems Installers guide US. Volume 12, contractor to complete documentation on page 270 of the guide to request an engineering judgement from HILTI. Completed form(s) to be faxed to 918-254-1679.

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 Contracting Officer Representative.
- C. Clean up spills of liquid type materials.

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

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. Masonry control and expansion joint: Section 04 20 00, UNIT MASONRY.
- C. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- D. Glazing: Section 08 80 00, GLAZING.
- E. Glazed aluminum curtain wall: Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.
- F. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION
- G. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
- H. Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

1.3 QUALITY CONTROL:

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. 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 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 Contracting Officer Representative seven days in advance of dates and times when test joints will be erected.
- 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 32° C (90° F) or less than 5° C (40° F).

1.7 DEFINITIONS:

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

1.8 WARRANTY:

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", 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.
 - C612-10.....Mineral Fiber Block and Board Thermal Insulation.
 - C717-10.....Standard Terminology of Building Seals and Sealants.
 - C834-10.....Latex Sealants.
 - C919-08.....Use of Sealants in Acoustical Applications.
 - C920-10.....Elastomeric Joint Sealants.
 - C1021-08.....Laboratories Engaged in Testing of Building Sealants.
 - C1193-09.....Standard Guide for Use of Joint Sealants.
 - C1330-02 (R2007).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - D1056-07.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
 - E84-09.....Surface Burning Characteristics of Building Materials.
- C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS:

- A. S-1:
- 1. ASTM C920, polyurethane or polysulfide.
 - 2. Type M.
 - 3. Class 25.
 - 4. Grade NS.

5. Shore A hardness of 20-40
- B. S-2:
1. ASTM C920, polyurethane or polysulfide.
 2. Type M.
 3. Class 25.
 4. Grade P.
 5. Shore A hardness of 25-40.
- C. S-3:
1. ASTM C920, polyurethane or polysulfide.
 2. Type S.
 3. Class 25, joint movement range of plus or minus 50 percent.
 4. Grade NS.
 5. Shore A hardness of 15-25.
 6. Minimum elongation of 700 percent.
- D. S-4:
1. ASTM C920 polyurethane or polysulfide.
 2. Type S.
 3. Class 25.
 4. Grade NS.
 5. Shore A hardness of 25-40.
- E. S-5:
1. ASTM C920, polyurethane or polysulfide.
 2. Type S.
 3. Class 25.
 4. Grade P.
 5. Shore hardness of 15-45.
- F. S-6:
1. ASTM C920, silicone, neutral cure.
 2. Type S.
 3. Class: Joint movement range of plus 100 percent to minus 50 percent.
 4. Grade NS.
 5. Shore A hardness of 15-20.
 6. Minimum elongation of 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, acetoxycure.
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. ASTM 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 as approved by the COR, 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.

3.6 FIELD QUALITY CONTROL:

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform one test for each 300 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:
1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
 2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 3. Whether sealants filled joint cavities and are free from voids.

4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING:

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

3.8 LOCATIONS:

- A. Exterior Building Joints, Horizontal and Vertical:
 1. Metal to Metal: Type S-1, S-2
 2. Metal to Masonry or Stone: Type S-1
 3. Masonry to Masonry or Stone: Type S-1
 4. Stone to Stone: Type S-1
 5. Cast Stone to Cast Stone: Type S-1
 6. Threshold Setting Bed: Type S-1, S-3, S-4
 7. Masonry Expansion and Control Joints: Type S-6
 8. Wood to Masonry: Type S-1
- B. Metal Reglets and Flashings:
 1. Flashings to Wall: Type S-6
 2. Metal to Metal: Type S-6
- C. Sanitary Joints:

1. Walls to Plumbing Fixtures: Type S-9
2. Pipe Penetrations: Type S-9

D. Horizontal Traffic Joints:

1. Concrete Paving, Unit Pavers: Type S-12
2. Garage/Parking Decks: Type S-10

E. Interior Caulking:

1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1 and C-2.
2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1 and C-2.
3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1 and C-2.
4. Exposed Isolation Joints at Top of Full Height Walls: Types C-1 and C-2.

- - - E N D - - -

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:
 - 1. Metal Plate Cover
 - 2. Elastomeric Joint Covers
 - 3. 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 ACCESSORIES.
- C. Color of Elastomer Inserts, Filler Strips, Exterior Wall Seals and Metal Finishes: Section 09 06 00, SCHEDULE FOR FINISHES
- D. Steel Plate Expansion Joint Covers: Section 05 50 00, METAL FABRICATIONS.
- E. Expansion joint systems for vehicular traffic as indicated on the waterproofing drawings.

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. Stainless Steel: ASTM A167, Type 302 or 304.
- B. Structural Steel Shapes: ASTM A36.
- C. Steel Plate: ASTM A283, Grade C.
- D. Rolled Steel Floor Plate: ASTM A786.
- E. Aluminum:
 - 1. Extruded: ASTM B221, alloy 6063-T5.
 - 2. Plate and Sheet: ASTM B209, alloy 6061-T6.
- F. Brass: ASTM B36.
- G. Elastomeric Sealant (unless specified otherwise):
 - 1. ASTM C920, polyurethane.
 - 2. Type.
 - 3. Class 25.
 - 4. Grade P or NS.
 - 5. Shore A hardness 25, unless specified otherwise.
- H. Expansion Joint System for Vehicular Traffic - Multicell
Gland/Ambient Cured Nosing:
 - 1. Expansion Joint System shall be capable of bearing
vehicular traffic while maintaining a watertight seal.
Expansion joint shall be capable of cyclic movement
expected at joint without overstress in gland or nosing
material.

2. Elastomeric membrane shall be a multicell extruded shape gland with integral perforated side flanges made from Santoprene thermoplastic rubber.
3. Nosing material shall be ambient cured, elastomeric, 100% solids, two-component urethane resin plus sand mixture.
4. Provide preformed or fabricated wall mount plates with appropriate anchors and sealants.
5. Approved Elastomeric Membrane with Ambient Cured Urethane Nosing Expansion Joint Systems for Vehicular Traffic are:
 - a. Thermaflex TCR Membrane Nosing System (TCR-300), Emseal Joint Systems, LTD, Westborough, MA.
 - b. Polycrete/Membrane CR-Series System (CR-325), Erie Metals Specialties, Inc., Akron, NY.
 - c. Iso-Flex Winged Expansion Joint Sealing System (J30), LymTal International, Inc., Orion, MI.
 - d. WaboCrete II/Membrane 201 Expansion Joint System (ME-300), Watson Bowman Acme Corp., Amherst, NY.
 - e. LokCrete Membrane System (LMS-350), MM Systems Corp., Pendergrass, GA.
 - f. Or approved equivalent.
- I. Thermoplastic Rubber:
 1. ASTM C864.
 2. Dense Neoprene or other material standard with expansion joint manufacturers having the same physical properties.
- J. Vinyl Invertor Sealant Waterstops: Manufacturers' standard shapes and grade.
- K. Fire Barrier:
 1. Designed for indicated or required dynamic structural movement without material degradation or fatigue.
 2. Tested in maximum joint width condition as a component of an expansion joint cover assembly in accordance with UL 263 NFPA 251, or ASTM E119 and E814, including hose steam test at full-rated period.
- L. Zinc-Molybdate Primer: Fed. Spec. TT-P-645.
- M. 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. Compatible with materials in contact.
 3. Water stops.

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. Fire Performance Characteristics:
 - a. Provide expansion joint cover assemblies identical to those of assemblies whose fire resistance has been determined per ASTM E119 and E814, NFPA 251, or UL 263 including hose stream test at full-rated period.
 - b. Fire rating: Not less than rating of adjacent floor or wall construction.
 7. Fire Barrier Systems:
 - a. Material to carry label of approved independent testing laboratory, and be subject to follow-up system for quality assurance.
 - b. Include thermal insulation where necessary, in accordance with above tests, with factory cut miters and transitions.
 - c. For joint widths up to and including 150 mm (six inches), supply barrier in lengths up to 15000 mm (50 feet) to eliminate field splicing.
 - d. For joint widths of seven inches and wider, supply barrier 3000 mm (10-foot) modules with overlapping ends for field splicing.
 - e. For joints within enclosed spaces such as chase walls, include 1 mm (0.032-inch) thick galvanized steel cover where conventional expansion joint cover is not used.
 8. Seal Strip factory - formed and bonded to metal frames and anchor members.
 9. Compression Seals: Prefabricate from thermoplastic rubber or dense neoprene to sizes and approximate profiles shown.
- B. Floor-to-Floor Metal Plate Joints:
1. Frames on each side of joint designed to support cover plate of design shown.
 - a. Continuous frame designed to finish flush with adjacent floor of profile indicated with seating surface and raised floor rim to accommodate flooring.
 - b. Provide concealed bolt and steel anchors for embedment in concrete.
 - c. Designed for filler materials between raised rim of frame and edge of cover plate where shown.
 - d. Frame and cover plates of some metal where exposed.
 - 1) Design cover plates to support 180 Kg (400 lbs) per 0.3 square meters (1-square foot).
 - 2) Cover plates free of rattle due to traffic.
 - 3) No gaps or budes occur on filler material during design movement of joint.
 - 4) Provide manufacturer's continuous standard flexible vinyl water stop under floor joint cover assemblies.

- C. Floor-to-Wall Metal Plate Joints:
 - 1. Provide one frame on floor side of joint only. Provide wall side frame where required by manufacturer's design.
 - 2. Angle Cover Plates: Provide angle cover plates for joints to wall with countersunk flat-head exposed fasteners for securing to wall unless shown otherwise.
 - 3. Space fasteners as recommended by manufacturer.
 - 4. Match cover of adjacent floor to floor cover.
- D. 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 to 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.
- E. 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 multimovement 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.
- F. 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 in section 09 06 00, SCHEDULE FOR FINISHES.
 - 5. Vinyl insert semi rigid either flush face or accordion shape as showed to span joint width without sagging.
- G. 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.
 - a. Color:
 - 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.
 - b. Color anodized finish: AA-C22A42, Chemically etched medium matte, integrally colored anodic coating, Class I Architectural, 0.7-mil thick; or AA-C22A44, Chemically etched medium matte, electrolytically deposited metallic compound, Class I Architectural, 0.7-mil thick finish. Dyes not accepted.
 - 2. Fluorocarbon Finish: NAAMM AMP 503 AAMA 605.2, high performance organic coating.

- 3. Factory-Primed Concealed Surface: NAAMM AMP 505 Protect concealed aluminum surfaces that will be in contact with plaster, concrete or masonry surfaces when installed by applying a shop coat of zincmolybdate primer to contact surfaces. Provide minimum dry film thickness of 2.0 mils.
- C. Bronze Finish: NAAMM-AMP 502-M32, mechanical finish, directional textured, natural medium satin.
- D. Stainless Steel: NAAMM AMP 503, finish No. 2B.
- E. Carbon Steel: NAAMM AMP 504, Galvanized 690.

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:
 - A. 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.

---END---

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Frames fabricated of structural steel: Section 05 50 00, METAL FABRICATIONS.
- B. Aluminum frames entrance work: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- C. Doors and frames of a forced entry/ballistic resistant rated: Section 08 34 53, SECURITY DOORS AND FRAMES.
- D. Overhead doors including loading docks: Section 08 33 00, COILING DOORS AND GRILLES.
- E. Windows and frames of a forced entry/ballistic resistant rated: Section 08 56 53, SECURITY WINDOWS.
- F. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- G. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.
- H. Package transfer boxes: Section 11 17 36, PACKAGE TRANSFER UNITS.
- I. Steel mesh partitions, doors, service windows and hardware: Section 10 22 13, WIRE MESH PARTITIONS.
- J. Vault doors and day gates including frame and hardware: Section 08 34 59, VAULT DOORS AND DAYGATES.
- K. Deal trays of a Forced Entry/Ballistic Resistant rating: Section 08 56 59, SERVICE AND TELLER WINDOW UNITS.
- L. Guard Booths: Section 13 34 19, METAL BUILDING SYSTEMS.
- M. Card readers and biometric devices: Section 28 13 00, ACCESS CONTROL.
- N. Intrusion Alarm: Section 28 16 11, INTRUSION DETECTION SYSTEM.
- O. Security Monitors: Section 28 51 00, SECURITY CONTROL CENTER.

1.3 TESTING

An independent testing laboratory shall perform testing.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
 - 1. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements and temperature rise rating for stairwell doors. Submit proof of temperature rating.

1.5 SHIPMENT

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

1.6 STORAGE AND HANDLING

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

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - L-S-125B.....Screening, Insect, Nonmetallic
- C. Door and Hardware Institute (DHI):
 - A115 Series.....Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)
- D. Steel Door Institute (SDI):
 - 113-01 (R2006).....Thermal Transmittance of Steel Door and Frame Assemblies
 - 128-09.....Acoustical Performance for Steel Door and Frame Assemblies
- E. American National Standard Institute:
 - A250.8-2003 (R2008).....Specifications for Standard Steel Doors and Frames
- F. American Society for Testing and Materials (ASTM):
 - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - A568/568-M-11.....Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled

- A1008-10.....Steel, sheet, Cold-Rolled, Carbon, Structural,
High Strength Low Alloy and High Strength Low
Alloy with Improved Formability
- B209/209M-10.....Aluminum and Aluminum-Alloy Sheet and Plate
- B221/221M-12.....Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Profiles and Tubes
- D1621-10.....Compressive Properties of Rigid Cellular
Plastics
- D3656-07.....Insect Screening and Louver Cloth Woven from
Vinyl Coated Glass Yarns
- E90-09.....Laboratory Measurement of Airborne Sound
Transmission Loss of Building Partitions
- G. The National Association Architectural Metal Manufacturers (NAAMM):
Metal Finishes Manual (AMP 500-06)
- H. National Fire Protection Association (NFPA):
80-13.....Fire Doors and Fire Windows
- I. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory
- J. Intertek Testing Services (ITS):
Certifications Listings...Latest Edition
- K. Factory Mutual System (FM):
Approval Guide

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A167, Type 302 or 304; finish, NAAMM Number 4.
- B. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- C. Anchors, Fastenings and Accessories: Fastenings anchors, clips
connecting members and sleeves from zinc coated steel.
- D. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
- E. Aluminum Sheet: ASTM B209/209M.
- F. Aluminum, Extruded: ASTM B221/221M.
- G. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

2.2 FABRICATION GENERAL

- A. GENERAL:
1. Follow ANSI A250.8 for fabrication of standard steel doors, except
as specified otherwise. Doors to receive hardware specified in
Section 08 71 00, DOOR HARDWARE. Tolerances as per ANSI A250.8.
Thickness, 44 mm (1-3/4 inches), unless otherwise shown.

2. Close top edge of exterior doors flush and seal to prevent water intrusion.
 3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.
- C. Heavy Duty Doors: ANSI A250.8, Level 2, Full flush seamless design of size and design shown. Core construction types types b, c, e, or f, for exterior doors.

Core Construction Type	Door Core Description
a	Kraft honeycomb
b	Polyurethane
c	Polystyrene
d	Unitized steel grid
e	Mineral fiberboard
f	Vertical steel stiffeners

- G. Custom Metal Hollow Doors:
1. Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design, materials, construction, gages and finish shall be as specified for of standard steel doors.

2.3 METAL FRAMES

A. General:

1. ANSI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
2. Frames for exterior doors: Fabricate from 1.7 mm (0.067 inch) thick galvanized steel conforming to ASTM A525.
3. Frames for labeled fire rated doors and windows.
 - a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual.
 - b. Fire rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements.

Provide labels of metal or engraved stamp, with raised or incised markings.

C. Terminated Stops: ANSI A250.8.

D. Glazed Openings:

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

E. Frame Anchors:

1. Floor anchors:

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

2. Jamb anchors:

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart.
- b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
- c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use one of following type:
 - 1) Wire loop type of 5 mm (3/16 inch) diameter wire.
 - 2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.

- d. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.
- e. Anchors for frames set in prepared openings:
 - 1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.
 - 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
 - 3) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.
- f. Anchors for observation windows and other continuous frames set in stud partitions.
 - 1) In addition to jamb anchors, weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
 - 2) Anchors spaced 600 mm (24 inches) on centers maximum.
- g. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

2.4 TRANSOM PANELS

- A. Fabricate panels as specified for flush doors.
- B. Fabricate bottom edge with rabbet stop to fit top of door where no transom bar occurs.

2.5 LOUVERS

- A. General:
 - 1. Sight proof type with stationary blades the full thickness of the door.
 - 2. Design lightproof louvers to exclude passage of light but permit free ventilation.
 - 3. Provide insect screen and wire guards at exterior doors, except where doors are located below completely enclosed areaways, the wire guard is not required.
- B. Fabrication:
 - 1. Steel louvers 0.8 mm (0.032 inch) thick for interior doors, and 1.3 mm (0.053 inch) inch thick for exterior doors.
 - 2. Fabricate louvers as complete units. Install in prepared cutouts in doors.
 - 3. Weld stationary blades to frames. Weld louvers into door openings.
- C. Screen frames:

1. Frame of either extruded aluminum or tubular aluminum.
2. Fabricate frame to hold wire fabric in a channel with a retaining bar anchor and to mount on surface of door with screws.
3. Do not lap frame over louver opening.
4. Miter corners of frame members and join by concealed mechanical fastenings extending about 57 mm (2-1/4 inches) into ends of each member.
5. Drill frame and doors for screw attachment. Space screws 50 mm (2 inches) from end of each leg of frame and not over 300 mm (12 inches) on center between end screws.
6. Finish: Clear anodized finish, 0.4 mils thick.
7. Insect Screens: Fasten insect screens to interior side of doors with retaining bar against door and not exposed to view.
8. Wire Guards:
 - a. Wire fabric shall be wire guard screen as specified.
 - b. Fasten wire guard to exterior side of door with retaining bar against door and not exposed to view.

2.6 SHOP PAINTING

ANSI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Plumb, align and brace frames securely until permanent anchors are set.
1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
 2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
 3. Protect frame from accidental abuse.
 4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
 5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.
- B. Floor Anchors:
1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
 2. Power actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:

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

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

E. Frames for Sound Rated Doors: Coordinate to line frames for sound rated doors with insulation.

F. Overhead Bracing (Lead Lined Frames): Where jamb extensions extend to structure above, anchor clip angles with not less than two, 9 mm (3/8 inch) expansion bolts or power actuated drive pins to concrete slab. Weld to steel overhead members.

3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE

Install doors and hardware as specified in Sections: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES Section 08 71 00, DOOR HARDWARE.

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SECTION 08 36 13
SECTIONAL DOORS

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies electrically operated thermal insulated sectional overhead steel doors.

1.2 RELATED WORK:

- A. Lock cylinders for cylindrical locks: Section 08 71 00, DOOR HARDWARE.
- B. Field painting: Section 09 91 00, PAINTING.
- C. Electrical Installation: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

1.3 MANUFACTURER'S AND INSTALLER'S QUALIFICATIONS:

- A. Manufacturer's regularly engaged in manufacturing items of type specified.
- B. Installers under direct supervision of manufacturer's representative or trained personnel.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Details of construction, accessories and hardware, electrical and mechanical items, supporting brackets for motors, location, and ratings of motors, and safety devices.
 - 2. Wiring diagrams for motors and controls, including wiring diagram for door, showing electrical interlock for motor with manually operated dead lock.
- C. Manufacturer's Literature and Data:
 - 1. Brochures or catalog cuts.
 - 2. Manufacturer's installation procedures and instructions.
 - 3. Maintenance instructions, parts list.
- D. Certificates:
 - 1. Attesting door, anchors and hardware will withstand the horizontal loads specified.
 - 2. Attesting door complies with thermal performance, air infiltration, and water infiltration requirements.

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 the basic designation only.
- B. American Society for Testing and Materials (ASTM):
- A36/A36M-08.....Structural Steel
 - A227/A227M-06.....Steel Wire, Cold-Drawn for Mechanical Springs
 - A229/229M-99(R2005).....Steel Wire, Oil-Tempered for Mechanical Springs
 - A653-10.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy Coated (Galvanized) by the Hot Dip Process
 - C1036-06.....Flat Glass
 - E283-04.....Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Difference Across the Specimen
 - E330-02(R2010).....Structural Performance of Exterior Windows, Curtain Walls, and Doors by the Uniform Static Air Pressure Difference.
 - E331-00(R2009).....Water Penetration of Exterior Windows, Curtain Walls, and Doors by the Uniform Static Air Pressure Difference.
- C. American National Standards Institute and Door and Access Systems Manufacturers Association (ANSI/DASMA):
- 102-04.....Sectional Overhead Type Doors.
- D. National Electrical Manufacturer's Association (NEMA):
- ICS 2-00 (R2005).....Industrial Control and Systems: Controllers, Contactors, and Overload Relays
 - MG 1-10.....Motors and Generators
- E. National Fire Protection Association (NFPA):
- 70-11.....National Electrical Code
- F. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500-06.....Metal Finishes Manual

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Steel: ASTM A653 for forming operations. ASTM A36 for structural sections.
- B. Hard Drawn Spring wire: ASTM A227.

- C. Oil Tempered Spring wire: ASTM A229.
- D. Weather-strips, Gaskets, and Thermal Breaks:
 - 1. Neoprene, EPDM, PVC, silicone rubber, or other low conductance material.
 - 2. Standard with door manufacturer.

2.2 DESIGN REQUIREMENTS:

- A. Wind Load: Design to withstand a horizontal or wind pressure of 960 Pa (20 pounds per square foot) of door area without damage when tested in accordance with ASTM E330.
- B. Air Infiltration: Maximum of 0.10 cfm at 24 Km (15 miles per hour) wind speed per foot of crack between door sections and door perimeter opening when tested in accordance with ASTM E283.
- C. Water Infiltration: No infiltration when tested in accordance with ASTM E331.
- D. Comply with ANSI/NAGDM 102, for an Industrial door and specified design criteria, inside face mounted with tracks at jambs set back a sufficient distance to provide a clear opening when door is in open position.
- E. Operation-Cycle Requirements: Door components and operators to operate for not less than 10,000 cycles.

2.3 FABRICATION:

- A. Steel Door Sections:
 - 1. Formed of hot-dipped galvanized steel.
 - 2. Meeting rails: interlocking joints with thermal breaks separating face sheets formed to provide weathertight closure and alignment for full width of door.
 - 3. Height of sections: Not to exceed 600 mm (24 inches) may be varied to suit door height.
 - 4. Insulation shall have a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with ASTM E 84.
 - 5. Reinforced for hardware anchorage with not less than 10 gage galvanized steel.
- B. Tracks:
 - 1. Manufacturer's standard formed of galvanized steel.
 - 2. Minimum of 14 gage for 50 mm (2 inch) tracks and 12 gage for 75 mm (3 inch) tracks.

3. Vertical tracks fabricated with adjustable brackets for mounting at incline to continuous steel angle wall bracket.
4. Horizontal track: Reinforce with continuous steel angle anchored to vertical steel angle wall bracket and to ceiling angle supports. Use vertical and cross or diagonal braced to obtain rigid installation of horizontal track.
5. Use not less than 13 gage galvanized steel angles.

C. Hardware:

1. Manufacturers standard hinges, brackets, rollers, locking devices and other hardware required for a complete installation.
2. Hinges and roller brackets minimum of 13 gage galvanized steel.
3. Use rollers with ball bearings and case hardened races.
4. Positive locking device to receive cylinder lock, specified in Section 08 71 00, DOOR HARDWARE, with interlocking switch to motor operator.

2.4 ELECTRIC MOTOR OPERATORS:

- A. Complete with electric motor, machine cut reduction gears, steel chain and sprockets, magnetic brake, overload protection, brackets, push button controls, limit switches, magnetic reversing contactor, and other accessories necessary for proper operation, including emergency manual operator.

B. Design:

1. Design the operator for motor removal without disturbing the limit-switch timing and without affecting the emergency manual operators.
2. Make provision for emergency manual operation of door by chain-gear mechanism in case of electrical failure.
3. Arrange the emergency manual operating mechanism to immediately be put into and out of operation from the floor with a mechanical device to disconnect the motor from the operating mechanism when the emergency manual operating mechanism is engaged and not affect the timing of the limit switches.
4. Provide interlock with motor to prevent motor from operating when manual locks are activated.

C. Motors:

1. Motor conform to NEMA MG 1, maximum operation 3600 rpm.
2. Suitable for operation on current specified in Division 26, ELECTRICAL.

3. Use high starting torque, reversible type, of sufficient horsepower and torque output to move the door in either direction from door position, and produce door travel speed range of 0.20 to 0.30 m per second (8 to 12 inches per second), without exceeding the rated capacity.
4. Single-phase motors shall not have commutation or more than one starting contact.
5. Motor Enclosures: Drip proof type or NEMA TENV type.

D. Controls:

1. Control equipment: NEMA 2.
2. Control enclosures: NEMA ICS 6, Type 12 or Type 4, except that contractor enclosures may be Type 1. Use weatherproof corrosion-resistant covers for exterior locations.
3. At door motors use an enclosed, across-the-line type, magnetic reversing contactor, thermal overload protection, solenoid operated brake, limit switches, and remote control switches at locations indicated.
4. Control switches:
 - a. Three push button type on interior, unless noted to be key activated.
 - b. Buttons marked, OPEN, CLOSE and STOP.
 - c. The OPEN and STOP buttons: Momentary pressure or contact type.
 - d. The CLOSE button: Constant pressure type.
 - e. Use key activated switch on exterior requiring constant pressure to operate.
 - f. Limit switches: Manufacturers standard, position of switches readily adjustable.
5. Operation:
 - a. Open door upon activation of Open switch.
 - b. Close door only when constant pressure applied.
 - c. When the door is in motion, and the STOP button is pressed, door shall stop instantly and remain in the stop position; from stop position, door may be operated in either direction by OPEN or CLOSE button.
 - d. Limit switches automatically stop doors at their fully open and closed positions.
6. Push buttons full-guarded to prevent accidental operation.
7. Transformer:

- a. Use a control transformer in power circuits to reduce the voltage on control circuits to 120 volts or less.
 - b. Conform to NEMA ST 20.
8. Electrical Components: Conform to NFPA 70.
9. Safety Device:
 - a. Bottom door edge weather-strip safety device to immediately stop and reverse the door closing to full open position upon contact with an obstruction. Door is to open upon failure of device, component of device or component of control system.
 - b. The door closing circuit shall be electrically locked out and door to remain capable of manual operation until the failure or damage has been corrected.
 - c. Do not use as a limit switch.
 - d. Safety device connecting cable to motor to be flexible type SO cable with spring loaded automatic take up reel or equivalent device, as required for proper operation of the doors.

2.5 FINISHES:

- A. Steel:
 1. Comply with NAAMM's Metal Finishes Manual.
 2. Clean surfaces free of scale, rust, oil and grease.
 3. Non-galvanized steel: Pretreatment to assure maximum paint adherence.
 4. Galvanized steel: Apply phosphate treatment.
 5. Apply shop prime coat of corrosion inhibitive paint on exposed surfaces after fabrication.
 6. Apply finish paint on color scheduled when specified in Section 09 06 00, SCHEDULE FOR FINISHES.
 7. Do not paint track, rollers, hinges, or locks.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install in accordance with approved shop drawings and manufacturer's instructions. For electrical work, see Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Locate anchors and inserts for tracks, brackets, motors, switches, hardware, and other accessories accurately.
- C. Securely attach tracks to adjoining construction with not less than 9 mm (3/8 inch) diameter bolts, spaced near each end and not over 600 mm (24 inches) apart.

- D. Locate control switches where shown at least five feet above the floor line so that the operator will have complete visibility of the door.
- E. Lubricate, properly adjust and demonstrate door to operate freely.
- F. Upon completion, door openings shall be weathertight and doors shall be free from warp, twists, or distortion.

3.2 REPAIR:

- A. Repair zinc-coated surfaces both bare and painted, by the application of galvanizing repair compound.
- B. Spot prime and apply finish paint to all repairs.

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SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies aluminum entrance work including storefront assembly construction, hung doors and other components to make a complete assembly.

1.2 RELATED WORK:

- A. Glass and Glazing: Section 08 80 00, GLAZING.
- B. Hardware: Section 08 71 00, DOOR HARDWARE.
- C. Automatic Door Operators: Section 08 71 13, AUTOMATIC DOOR OPERATORS.
- D. Texture and color of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: (1/2 full scale) showing construction, anchorage, reinforcement, and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Doors, each type.
 - 2. Entrance and Storefront construction.
- D. Samples:
 - 1. Door corner section, 450 mm x 450 mm (18 x 18 inches), of each door type specified, showing vertical and top hinge edges, and internal reinforcement .
 - 2. Two samples of anodized aluminum of each color showing finish and maximum shade range.
- E. Manufacturer's Certificates:
 - 1. Stating that aluminum has been given specified thickness of anodizing.
 - 2. Indicating manufacturer's qualifications specified.

1.4 QUALITY ASSURANCE:

- A. Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
- B. Certify manufacturer regularly and presently manufactures aluminum entrances and storefronts as one of their principal products.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Deliver aluminum entrance and storefront material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.
- B. Store aluminum entrance and storefront material in weather-tight and dry storage facility.
- 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. American Society for Testing and Materials (ASTM):
 - B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate
 - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - E283-04.....Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - E331-00(R2009).....Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
 - F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
 - F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and Studs
- C. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series.....Metal Finishes Manual
- D. American Architectural Manufacturer's Association (AAMA):
 - 2604-10.....High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
- E. American Welding Society (AWS):
 - D1.2-08.....Structural Welding Code Aluminum

1.7 PERFORMANCE REQUIREMENTS:

- A. Shapes and thickness of framing members shall be sufficient to withstand a design wind load of not less than [1.4] kilopascals ([30] pounds per square foot) of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not

less than 1.65 (applied to overall load failure of the unit). Provide glazing beads, moldings, and trim of not less than 1.25 mm (0.050 inch) nominal thickness.

- B. Air Infiltration: When tested in accordance with ASTM E 283, air infiltration shall not exceed 2.63×10^{-5} cm per square meter (0.06 cubic feet per minute per square foot) of fixed area at a test pressure of 0.30 kPa (6.24 pounds per square foot) 80 kilometers (50 mile) per hour wind.
- C. Water Penetration: When tested in accordance with ASTM E 331, there shall be no water penetration at a pressure of 0.38 kPa (8 pounds per square foot) of fixed area.

PART 2 - PRODUCTS

Provide Aluminum Curtain Wall and Storefront products from the following manufacturers or equal:

- A. Provide Aluminum Curtain Wall and Storefront products equivalent to the basis of design product:
 - a. Model: Kawneer Trifab® VG451 Storefront System, thermally broken

2.1 MATERIALS:

- A. Aluminum, ASTM B209 and B221:
 - 1. Alloy 6063 temper T5 for doors, door frames, fixed glass sidelights, storefronts, and transoms.
 - 2. Alloy 6061 temper T6 for guide tracks for sliding doors and other extruded structural members.
 - 3. For color anodized finish, use aluminum alloy as required to produce specified color.
- B. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework, where insulating glass is scheduled.
- C. Fasteners:
 - 1. Aluminum: ASTM F468, Alloy 2024.
 - 2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.

2.2 FABRICATION:

- A. Fabricate doors, of extruded aluminum sections not less than 3 mm (0.125 inch) thick. Fabricate glazing beads of aluminum not less than 1.0 mm (0.050 inch) thick.

- B. Accurately form metal parts and accurately fit and rigidly assemble joints, except those joints designed to accommodate movement. Seal joints to prevent leakage of both air and water.
- C. Make welds in aluminum in accordance with the recommended practice AWA D1.2. Use electrodes and methods recommended by the manufacturers of the metals and alloys being welded. Make welds behind finished surfaces so as to cause no distortion or discoloration of the exposed side. Clean welded joints of welding flux and dress exposed and contact surfaces.
- D. Make provisions in doors and frames to receive the specified hardware and accessories. Coordinate schedule and template for hardware specified under Section 08 71 00, DOOR HARDWARE. Where concealed closers or other mechanisms are required, provide the necessary space, cutouts, and reinforcement for secure fastening.
- E. Fit and assemble the work at the manufacturer's plant. Mark work that cannot be permanently plant-assembled to assure proper assembly in the field.

2.3 PROTECTION OF ALUMINUM:

- A. Isolate aluminum from contact with dissimilar metals other than stainless steel, white bronze, or zinc by any of the following:
 - 1. Coat the dissimilar metal with two coats of heavy-bodied alkali resistant bituminous paint.
 - 2. Place caulking compound, or non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
 - 3. Paint aluminum in contact with mortar, concrete and plaster, with a coat of aluminum paint primer.

2.4 FRAMES:

- A. Fabricate doors, frames, mullions, transoms, frames for fixed glass and similar members from extruded aluminum not less than 3 mm (0.125 inch) thick.
- B. Provide integral stops and glass rebates and applied snap-on type trim.
- C. Use concealed screws, bolts and other fasteners. Secure cover boxes to frames in back of all lock strike cutouts.
- D. Fabricate framework with thermal breaks in frames where insulating glass is scheduled and specified under Section 08 80 00, GLAZING.

2.5 STILE AND RAIL DOORS:

- A. Nominal 45 mm (1-3/4 inch) thick, with stile and head rail 90 mm (3-1/2 inches) wide, and bottom rail 250 mm (10 inches) wide.

- B. Bevel single-acting doors 3 mm (1/8 inch) at lock, hinge and meeting stile edges. Provide clearances of 2 mm (1/16 inch) at hinge stiles, 3 mm (1/8 inch) at lock stiles and top rails, and 5 mm (3/16 inch) at floors and thresholds. Form glass rebates integrally with stiles and rails. Glazing beads may be formed integrally with stiles and rails or applied type secured with fasteners at 150 mm (six inches) on centers.
- C. Construct doors with a system of welded joints or interlocking dovetail joints between stiles and rails. Clamp door together through top and bottom rails with 9 mm (3/8 inch) primed steel rod extending into the stiles, and having a self-locking nut and washer at each end. Reinforce stiles and rails to prevent door distortion when tie rods are tightened. Provide a compensating spring-type washer under each nut to take up any stresses that may develop. Construct joints between rails and stiles to remain rigid and tight when door is operated.
- D. Weather-stripping: Provide removable, woven pile type (silicone-treated) weather-stripping attached to aluminum or vinyl holder. Make slots for applying weather-stripping integral with doors and door frame stops. Apply continuous weather-stripping to heads, jambs, bottom, and meeting stiles of doors and frames. Install weather-stripping so doors can swing freely and close positively.

2.6 FLUSH PANEL DOORS:

- A. Nominal 45 mm (1-3/4 inches) thick. Form from aluminum face sheets not less than 1.5 mm (0.060 inch) thick with internal impact reinforcement, laminated to the door edges and the core.
- B. Provide extruded aluminum tubular members to form the perimeter of the door. Reinforce doors internally with extruded tubular members welded in place, and extending full width of door at top, bottom, and intermediate points.
- C. Fill voids between tubular members with noncombustible mineral insulation.

2.7 REINFORCEMENT FOR BUILDERS HARDWARE:

- A. Fabricate from stainless steel plates.
- B. Hinge and pivot reinforcing: 4.55 mm (0.1793 inch) thick.
- C. Reinforcing for lock face, flush bolts, concealed holders, concealed or surface mounted closers: 2.66 mm (0.1046 inch) thick.
- D. Reinforcing for all other surface mounted hardware: 1.5 mm (0.0598 inch) thick.

2.8 COLUMN COVERS AND TRIM

- A. Fabricate column covers and trim shown from 1.5 mm (0.0625 inch) thick sheet aluminum of longest available lengths.
- B. Use concealed fasteners.
- C. Provide aluminum stiffener and other supporting members shown or as required to maintain the integrity of the components.

2.9 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum:
 - 1. Clear Finish: Chemically etched medium matte, with clear anodic coating, Class I Architectural, 7 mils thick.
- C. Provide Clear Anodized Aluminum in locations where indicated on architectural drawings.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Allowable Installation Tolerances: Install work plumb and true, in alignment and in relation to lines and grades shown. Variation of 3 mm (1/8 inch) in 2400 mm (eight feet), non-accumulative, is maximum permissible for plumb, level, warp, bow and alignment.
- B. Anchor aluminum frames to adjoining construction at heads, jambs and bottom and to steel supports, and bracing. Anchor frames with stainless steel or aluminum countersunk flathead, expansion bolts or machine screws, as applicable. Use aluminum clips for internal connections of adjoining frame sections.
- C. Where work is installed within masonry or concrete openings, place no parts other than built-in anchors and provision for operating devices located in the floor, until after the masonry or concrete work is completed.
- D. Install hardware specified under Section 08 71 00, DOOR HARDWARE.
- E. Install hung door operators specified under Section 08 71 13, AUTOMATIC DOOR OPERATORS.

3.2 ADJUSTING:

After installation of entrance and storefront work is completed, adjust and lubricate operating mechanisms to insure proper performance.

3.3 PROTECTION, CLEANING AND REPAIRING:

Remove all mastic smears and other unsightly marks, and repair any damaged or disfiguration of the work. Protect the installed work against damage or abuse.

Salisbury VAMC
Construct New Parking Garage
Salisbury, NC 28144

Project No. 659-342

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SECTION 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies glazed aluminum curtain wall system.
 - 1. Thermally isolated, pressure equalized on interior.
 - 2. Type: Stick Unit and Mullion system to include following:
 - a. Integral reinforcing.
 - b. Closures, trim, subsills and flashings.
 - c. Column covers.
 - d. Fasteners, anchors, and related reinforcement.

1.2 RELATED WORK

- A. Structural steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Miscellaneous metal members: Section 05 50 00, METAL FABRICATIONS.
- C. Firestopping between curtain wall and structure: Section 07 84 00, FIRESTOPPING.
- D. Sheet metal flashing and trim: Section 07 60 00, FLASHING AND SHEET METAL.
 - a. Joint sealants: Section 07 92 00, JOINT SEALANTS.
- E. Aluminum and glass hinged entry doors and storefront construction: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- F. Aluminum windows: Section 08 51 13, ALUMINUM WINDOWS.
- G. Glazing: Section 08 80 00, GLAZING.
- H. Finish Color: Section 09 06 00, SCHEDULE FOR FINISHES.
- I. Louvers and wall vents: Section 08 90 00, LOUVERS AND VENTS.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Approval is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
 - a. Manufacturers Qualifications: Manufacturer with five (5) years continuous documented experience in design, fabrication, and installation of glazed aluminum curtain wall systems of type and size required for that project.
 - b. Installer: Manufacturer approved in writing. Continuously installed glazed aluminum curtain walls systems for previous five (5) years.
 - c. Manufacturer shall provide technical field representation at project site, as a minimum, at start of project, during middle,

towards end of project, and during field testing of field mockup panel.

- d. Testing Laboratory: Contractor retained. Engage an AAMA accredited commercial testing laboratory to perform tests specified. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to perform testing specified in this section.
- e. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of glazed aluminum curtain wall system. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.
 - 1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.
- f. Qualification of Welders:
 - 1) Welding shall be performed by certified welders qualified in accordance with AWS D1.2, using procedures, materials, and equipment of the type required for this work.

B. Mockup

- 1. Construct, at job site, full size typical wall unit which incorporates horizontal and vertical joints, framing, window units, panels, glazing, sealants, and other accessories as detailed and specified. Mock-up wall unit location, size and design shall be at ground floor of main stair tower and if approved can be incorporated into the final construction. Orient mockup to be facing full sun when constructed.
- 2. Performance Test
 - a. Conduct performance test after approval of visual aspects has been obtained. Finished work shall match approved mock-up.
 - b. Refer to Performance Requirements and Field Quality Control Articles, included hereinafter, for testing requirements.
- 3. Approved Mock-up
 - a. After completion and approval of test results of job site mockup, as directed, approved mock-up panel shall be used as minimum standard of comparison for entire curtain wall system.

C. Pre-Installation Conference

1. Prior to starting installation of glazed curtain wall system schedule conference with Contracting Officer to ensure following:
 - a. Clear understanding of drawings and specifications.
 - b. Onsite inspection and acceptance of structural and pertinent structural details relating to curtain wall system.
 - c. Coordination of work of various trades involved in providing system. Conference shall be attended by Contractor; personnel directly responsible for installation of curtain wall system, flashing and sheet metal work, firestopping system and curtain wall manufacturer and their Technical Field Representatives. Conflicts shall be resolved and confirmed in writing.

1.4 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Product Data:
 1. Manufacturer's standard details and fabrication methods.
 2. Data on finishing, components, and accessories.
 3. Instructions: Submit descriptive literature, detail specifications, available performance test data and instructions for installation, and adjustments.
 4. Recommendations for maintenance and cleaning of exterior surfaces.
- C. Shop Drawings:
 1. Show elevations of glazed curtain wall system at 1:50 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, glazing details, and details of installation.
 2. Submit for curtain wall system, accessories. Tentative approval of drawings shall be received before fabrication of mock-up. Final approval of drawings shall be deferred pending approval of mock-up and accessories. Drawings shall indicate in detail all system parts including elevations, full size sections, framing, jointing, panels, types and thickness of metal anchorage details, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, firestopping insulation materials, and erection details.
 3. Operation and Maintenance Manuals
 - a. Submit cleaning and maintenance instructions.
- D. Samples:
 1. Submit pairs of samples of each specified color and finish on 300 mm (12-inch) long section by width of each tubular, or extruded shape

section or 300 mm by 300 mm (12-inch by 12-inch) wide sections of sheet shapes.

2. Submit corner section of framing members showing fasteners, panels, glazing methods, glazing materials, and weather-stripping. Submit one sample minimum 300 mm by 300 mm (12 inches by 12 inches). In lieu of submitting separate samples for corner section, intermediate section, and panel, one composite sample incorporating all components and features listed may be submitted.
3. Where normal color variations are anticipated, include 2 or more units in set indicating extreme limits of color variations.

E. Glass:

1. Specified in Section 08 80 00, GLAZING.

F. Quality Control Submittals:

1. Design Data:

- a. Submit structural and thermal calculations for complete wall assembly. Structural calculations and design shop drawings shall be signed and sealed by a structural engineer registered in state in which project is to be located.

2. Factory Test Reports:

- a. Test Reports: Provide certified test reports, for each of following listed tests, from a qualified independent testing laboratory showing that glazed aluminum curtain wall system assembly has been tested in accordance with specified test procedures and complies with performance characteristics as indicated by manufacturer's testing procedures. Manufacturer shall submit appropriate testing numbers for specific tests indicated below.

- 1) Deflection and structural tests.
- 2) Water penetration tests.
- 3) Air infiltration tests.
- 4) Delamination tests.
- 5) Thermal conductance tests.
- 6) Submit factory tests required except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested within last year, under conditions specified herein, resulting test reports may be submitted in lieu of listed testing.

G. Manufacturer's Certificates:

1. Submit Certificates of Compliance, with specification requirements, for the following:

- a. Metal extrusions.
 - b. Metal accessories.
 - c. Stating that aluminum has been given specified thickness of anodizing or organic coating finish.
 - d. Indicating manufacturer's and installer's meet qualifications as specified.
 - e. Submit list of equivalent size installations, for both manufacturer and installer, which have had satisfactory and efficient operation.
- H. Manufacturer's Field Reports:
- 1. Submit field reports of manufacturer's field representative observations of curtain wall installation indicating observations made during inspection at beginning of project, during middle of installation and at conclusion of project. Indicate results of field testing of mockup field panel, and any directions given Contractor for corrective action.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.
- B. Prior to packaging for shipment from factory, mark wall components to correspond with shop and erection drawings and their placement location and erection.
- C. Prior to shipment from factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of members with protective covering of adhesive paper, waterproof tape, or strippable plastic. Do not cover metal surfaces that will be in contact with sealants after installation.
- D. Inspect materials delivered to site for damage; unload and store with ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Sealing and caulking compounds, including handling, shall be in accordance with requirements of Section 07 92 00 JOINT SEALANTS.

1.6 PROJECT CONDITIONS

Field Measurements: Where glazed aluminum curtain wall systems are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
- MCWM-1-89.....Metal Curtain Wall Manual
 - CW 10-04.....Care and Handling of Architectural Aluminum from Shop to Site
 - CW 11-85.....Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing
 - CW 13-85.....Structural Sealant Glazing Systems (A Design Guide)
 - CWG 1-89.....Installation of Aluminum Curtain Walls
 - TIR A1-04.....Sound Control for Fenestration Products
 - TIR A8-08.....Structural Performance of Composite Thermal Barrier Framing Systems
 - TIR A9-91.....Metal Curtain Wall Fasteners
 - TIR A11-04.....Maximum Allowable Deflection of Framing Systems for Building Cladding Components of Design Wind Loads
 - 101/I.S.2/A440-08.....Windows, Doors and Unit Skylights
 - 501-05.....Methods of Test for Exterior Walls
 - 503-08.....Field Testing of Metal Storefronts, Curtain walls and Sloped Glazing Systems
 - 2605-98.....High Performance Organic Coatings on Architectural Extrusions and Panels
 - 1503-09.....Thermal Transmission and Condensation Resistance of Windows, Doors and Glazed Wall Sections
- C. American National Standards Institute (ANSI):
- Z97.1-09.....Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test
- D. American Society of Civil Engineers (ASCE):
- ASCE 7-10.....Minimum Design Loads for Buildings and Other Structures
- E. American Society for Testing and Materials (ASTM):
- A36/A36M-08.....Structural Steel
 - A123-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - A193-10.....Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service

A307-10.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile
Strength

B209-10.....Aluminum and Aluminum Alloy Sheet and Plate

B211-03.....Aluminum and Aluminum Alloy Bar, Rod, Wire

B221/B221M-08.....Aluminum and Aluminum Alloy Extruded Bars, Rods,
Wire, Shapes and Tubes

B316/B316M-10.....Aluminum and Aluminum Alloy Rivet and Cold-
Heading, Wire, and Rods

C578-10.....Rigid Cellular Polystyrene Thermal Insulation

C612-10.....Mineral Fiber Block and Board Thermal Insulation

C920-11.....Elastomeric Joint Sealants

C794-10.....Standard Test Method for Adhesion-In-Peel of
Elastomeric Joint Sealants.

C1363-05.....Thermal Performance of Building Materials and
Envelope Assemblies by Means of a Hot Box
Apparatus

D1037-06.....Evaluating the Properties of Wood-Base Fibers
and Particle Panel Materials

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

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

E283-04.....Determining Rate of Air Leakage Through Exterior
Windows, Curtain Walls, and Doors under
Specified Pressure Difference Across this
Specification

E330-02(R2010).....Structural Performance of Exterior Windows,
Curtain Walls, and Doors by Uniform Static Air
Pressure Difference

E331-00(R2009).....Water Penetration of Exterior Windows, Curtain
Walls, and Doors By Uniform Static Air Pressure
Difference

E413-10.....Classification for Rating Sound Insulation

E783-02(R2010).....Test Method for Field Measurement of Air Leakage
Through Installed Exterior Windows and Doors.

E1105-00(R2008).....Field Determination of Water Penetration of
Installed Exterior Windows, Curtain Walls, and
Doors By Uniform or Cyclic Static Air Pressure
Differences

- F. American Welding Society, Inc. (AWS):
 - D1.2-08.....Structural Welding Code-Aluminum
- G. Consumer Product Safety Commission (CPSC):
 - 16 CFR 1201.....Architectural Glazing Standards and Related
Material
- H. Federal Specifications (FS):
 - TT-P-645B-90.....Primer, Paint, Zinc-Molybdate, Alkyd Type
- I. Glass Association of North America (GANA):
 - 2010 Edition.....GANA Glazing Manual
 - 2008 Edition.....GANA Sealant Manual
 - 2009 Edition.....GANA Laminated Glazing Reference Manual
 - 2008 Edition.....Tempered Glass Engineering Standard Manual
- J. Military Specifications (MIL):
 - MIL-C-18480.....(Rev. B) Coating Compound, Bituminous Solvent,
Coal Tar Base
- K. National Association of Architectural Metal Manufacturers (NAAMM):
 - 500 Series (2006).....Metal Finishes Manual.
- L. Steel Structures Painting Council (SSPC)
 - Paint 25-97 (2004).....Red Iron Oxide Raw Linseed Oil and Alkyd Primer
(Without Lead and Chromate Pigments)

1.8 WARRANTY

- A. Submit manufacturer's written warranty for materials, installation and weathertightness, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to five (5) years from date of final acceptance of project by Government.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Curtain Wall System: Tubular aluminum sections with thermal break condition, self supporting, supplementary support, framing, factory prefinished, vision glass,; related flashings, anchorage and attachment devices.
 - 2. System Assembly: Site assembled.
 - 3. No curtain wall framing member shall deflect, in a direction normal to plane of wall, more than 1/175 of its clear span or 20 mm (3/4 inch), whichever is less, when designed in accordance with requirements of TIR A11 and tested in accordance with ASTM E330, except that when a gypsum wallboard surface will be affected, deflection shall not exceed 1/360 of span. No framing member shall have a permanent deformation in excess of 0.2 percent of its clear

span when tested in accordance with ASTM E330 for a minimum test period of 10 seconds at 1.5 times design wind pressures indicated as part of structural drawing wind load requirements. No glass breakage, damage to fasteners, hardware or accessories shall be permitted due to deformation stated above:

- a. Provide system complete with framing, mullions, trim, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing wall to structure as specified or indicated. Unless noted otherwise, comply with MCWM-1.
 - b. Curtain wall system components and integral door and/or window units shall be furnished by one manufacturer or fabricator; however, all components need not be products of same manufacturer.
 - c. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and insure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified.
 - d. Provide system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects. For design purposes, base provisions for thermal movement on assumed ambient temperature range of from -18 degrees C to 49 degrees C (0 degrees F to 120 degrees F).
 - e. Provide wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified.
- B. Manufacturer's Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of curtain walls that are similar to those indicated for this Project in material, design, and extent.
- C. Performance Requirements:
1. System shall meet or exceed all performance requirements specified.
 2. Curtain wall components shall have been tested in accordance with requirements below and shall meet performance requirements specified:
 3. System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as calculated in accordance with ASCE 7-Minimum Design Loads for Buildings and Other Structures.

4. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with applicable codes.
5. Water Penetration:
 - a. No water penetration shall occur when wall is tested in accordance with ASTM E331 at a differential static test pressure of 20 percent of inward acting design wind pressure as indicated on structural drawings, but not less than 479 Pa (10 psf).
 - b. Make provision in wall construction for adequate drainage to outside of water leakage or condensation that occurs within outer face of wall. Leave drainage and weep openings in members and wall open during test.
6. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783
 - a. Static-Air-Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
 - b. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq ft) of surface maximum.
7. Deflections Test: ASTM E330, Procedure B:
 - a. No member shall deflect in a direction parallel to plane of wall, when carrying its full design load, more than an amount which will reduce edge cover or glass bite below 75 percent of design dimension. No member after deflection under full design load, shall have a clearance between itself and top of panel, glass, sash, or other part immediately below it less than 3 mm (1/8 inch); clearance between member and an operable window or door shall be minimum 1.5 mm (1/16 inch).

2.2 MATERIALS

- A. Extruded Aluminum Framing Members: ASTM B221M; 6063-T5 extruded aluminum for non-structural components or 6063-T6 extruded aluminum for structural members; temper and alloy as recommended by manufacturer.
- B. Sheet Aluminum: ASTM B209M; 6065-T5 temper and alloy as recommended by manufacturer.
 1. Formed flashing and closures: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
 2. Extruded sill members: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
- C. Steel Sections: ASTM A36M.
- D. Primer: TS TT-P-645; red, for shop application and field touch-up.
- E. Fasteners:

1. For Exterior Cap Retainers: ASTM A193 B8 300 series, stainless steel screws.
 2. For Framework Connections: ASTM B211M 2024-T4 aluminum, ASTM A193 B8 300 series, stainless steel, and ASTM B316 aluminum rivets, as required by connection.
 3. For Anchoring Glazed Aluminum Curtain Wall to Support Structure: ASTM A307 zinc plated steel fasteners.
- F. Shims: Metal or plastic.
- G. Joint Sealants and Accessories:
1. In accordance with requirements specified in Section 07 92 00, JOINT SEALANTS.
 2. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance with manufacturer's recommendations.
 3. Non-structural Flush Glazed Joints and Weather Seal Joints: Silicone sealants applied in accordance with manufacturer's recommendations.
 4. Structural silicone sealant performance requirements: ASTM C920.
 - a. Hardness: Type A, 30 durometer.
 - b. Ultimate Tensile Strength: 1172 kPa (170 psi).
 - c. Tensile at 150% Elongation: 55 kPa (80 psi).
 - d. Joint Movement Capability after 14 Day Cure: +/- 50%.
 - e. Peel Strength aluminum, after 21 Day Cure: 599 g/mm (34 pounds per inch).
 5. Structural silicone shall not be used to support dead weight of vertical glass or panels.
 6. Comply with recommendations of sealant manufacturer for specific sealant selections.
 7. Provide only sealants that have been tested per ASTM C794 to exhibit adequate adhesion to samples of glass and metal equivalent to those required for project.
 8. Exposed metal to metal joints: Silicone sealant selected from manufacturer's standard colors.
- H. Glazing Materials:
1. As specified under Section 08 80 00, GLAZING.
 2. Glazing Gaskets:
 - a. Exterior: Continuous EPDM gaskets at each glass and spandrel panel.
 - b. Interior: Continuous, closed cell PVC foam sealant tape, sealed at corners.
 3. Glass Sizes and Clearances:
 - a. Accommodate up to 25 mm (1 inch) glazing.

- b. Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip glass to remove flares or to reduce oversized dimensions. All cutting shall occur in factory.
- 4. Glass Setting Materials:
 - a. Provide head bead and drive wedge required for glass installation to suit curtain wall system in accordance with manufacture's recommendations.
 - b. If used in psychiatric facilities, the glass shall be retained in the framing system in such a manner that it can withstand lateral forces in excess of force required to break the glass. Plastic clips for holding glass are not permitted.

2.3 FABRICATION

- A. Curtain wall components shall be of materials and thickness indicated or specified. Details indicated are representative of required design and profiles. Maintain sightlines indicated on drawings. Unless specifically indicated or specified otherwise, methods of fabrication and assembly shall be at discretion of curtain wall manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices shall permit adjustment in three directions. There shall be no exposed fasteners.
- B. Joints: Joints exceeding +1.5 mm (+1/16") shall be mechanically fastened.
- C. Ventilation and Drainage: Direct water leakage to exterior by means of concealed drainage system and weeps. Flashings and other materials used internally shall be nonstaining, noncorrosive, and nonbleeding.
- D. Protection and Treatment of Metals:
 - 1. Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving shop.
 - 2. Provide protection against galvanic action wherever dissimilar metals are in contact, except in case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint conforming to MIL-C-18480 or apply appropriate caulking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

- E. Metal sills and Closures: Fabricate accessories, spandrel panels, trim closures of sizes and shapes indicated from similar materials and finish as specified for wall system.

2.4 PROTECTION

- A. Provide protection for aluminum against galvanic action, wherever dissimilar materials are in contact, by painting contact surfaces of dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on one side.

2.5 METAL FINISHES

- A. In accordance with NAAMM AMP500 series.
- C. Fluorocarbon Finish: AAMA 2605.
 - 1. Color to be: **White**.
- D. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 red oxide.
- E. Touch-Up Primer for galvanized Steel Surfaces: SSPC Paint 20 zinc rich.
- F. Concealed Steel Items: Galvanized in accordance with ASTM A123 to 610
- G. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of glazed curtain wall system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive glazed curtain wall work included herein.
- B. Verifying Conditions and Adjacent Surfaces: After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in building frame.

3.2 PREPARATION

- A. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this section is to be performed to verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint for prevention of electrolytic action and corrosion.

3.3 INSTALLATION

- A. Installation and erection of glazed curtain wall system and all components shall be in accordance with written directions of curtain wall manufacturer. Match profiles, sizes, and spacing indicated on approved shop drawings.
- B. Bench Marks and Reference Points: Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of marks, stop erection work in that area until discrepancies have been corrected.
- C. Ensure that drainage system operates properly in accord with AAMA 501 procedures.
- D. Do not proceed with structural silicone work when metal temperature is below 0 degrees C (32 degrees F).
- E. Isolate between aluminum and dissimilar metals with protective coating or plastic strip to prevent electrolytic corrosion.
- F. Install glazed aluminum curtain wall system so as to maintain a virtually flat face cap, with no visible bowing.
- G. Install entire system so that fasteners are not visible.
- H. Tolerances:
 - 1. Maximum variation from plane or location shown on approved shop drawings: 3 mm per 3600 mm (1/8 inch per 12 feet) of length up to not more than 13 mm (1/2 inch) in any total length.
 - 2. Maximum offset from true alignment between two identical members abutting end to end in line: 0.8 mm (1/32 inch).
 - 3. Sealant Space Between Curtain Wall Mullion and Adjacent Construction: Maximum of 19 mm (3/4 inch) and minimum of 6 mm (1/4 inch).
- I. Windows:
 - 1. Refer to Section 08 51 13, ALUMINUM WINDOWS for window requirements.
- J. Joint Sealants:
 - 1. Joint Sealants: Shall be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.
 - 2. Surfaces to be primed and sealed shall be clean, dry to touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions shall conform to approved detail drawings with a tolerance of plus 3 mm (1/8 inch). Do not apply compound unless ambient temperature is between 5 and 35 degrees C (40 and 90 degrees F). Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in

- contact with sealants before applying sealants or tapes. Solvents used to remove coatings shall be of type that leave no residue on metals.
3. Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound shall be uniformly smooth and free of wrinkles and, unless indicated otherwise, shall be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four hours, but at no time shall this amount exceed 19 liters (5 gallons).
 4. Apply primer to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after caulking is completed.
 5. Tightly pack backing in bottom of joints which are over 13 mm (1/2 inch) in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.
 6. Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.
 7. Remove compound smears from surfaces of materials adjacent to sealed joints as work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of caulking and sealing, remove remaining smears, stains, and other soiling, and leave work in clean neat condition.

K. Glass:

1. Refer to Section 08 80 00, GLAZING, and drawing for glass types. Install in accordance with manufacturer's recommendations as modified herein.
2. Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.
3. Clean sealing surfaces at perimeter of glass and sealing surfaces of rebates and stop beads before applying glazing compound, sealing

compound, glazing tape, or gaskets. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer. All sashes shall be designed for outside glazing. Provide continuous snap in glazing beads to suit glass as specified.

4. Insulating and tempered glass, and glass of other types that exceed 100 united inches in size: Provide void space at head and jamb to allow glass to expand or move without exuding sealant. Perimeter frames and ventilator sections shall have glazing rebates providing an unobstructed glazing surface 19 mm (3/4 inch) in height. Glazing rebate surfaces must be sloped to shed water.
5. Provide adequate means to weep incidental water and condensation away from sealed edges of insulated glass units and out of wall system. Weeping of lock-strip gaskets should be in accordance with recommendation of glass manufacturer.

L. Metal Copings:

1. Refer to Section 07 60 00, FLASHING AND SHEET METAL for requirements of metal copings when they are not a part of glazed curtain wall system work.
2. Coordinate curtain wall installation with metal coping detail on contract drawings. Provide watertight seal to meet criteria set forth in this section regarding air and water penetration.

3.4 ADJUSTING

- A. Adjust windows and doors to provide a tight fit at contact points and operate easily.
- B. Adjust weather-stripping to make even contact with surfaces.
- C. Adjust operating hardware and moving parts.

3.5 CLEANING

- A. Install curtain wall frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Replace cracked, broken, and defective glass with new glass at no additional cost to Government. Just prior to final acceptance of curtain wall system clean glass surfaces on both sides, remove labels, paint spots, compounds, and other defacements, and clean metal fixed panels. Remove and replace components that cannot be cleaned successfully.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an AAMA accredited commercial qualified independent testing and inspecting agency to perform field quality-control tests specified, and to prepare test reports: Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Contracting Officer for approval.
- B. Conduct field check test for water leakage on designated wall areas after erection to comply with MCWM-1. Conduct test on two wall areas, two bays wide by two stories high where directed. Conduct test and take necessary remedial action as directed by Contracting Officer.
- C. Test Specimen:
 - 1. Test specimen shall include curtain wall assembly and construction. Test chamber shall be affixed to exterior side of test specimen and test shall be conducted using positive static air pressure.
 - 2. Test specimens shall be selected by Contracting Officer after curtain wall system has been installed in accordance with contract drawings and specification.
- D. Sealant Adhesion Tests: Test installed sealant, in presence of sealant manufacturer's field representative, in a minimum of two areas and as follows:
 - 1. Test structural silicone sealant according to field adhesion test method described in AAMA CW 13, "Structural Sealant Glazing Systems (A Design Guide)."
 - 2. Test weatherseal sealant as recommended in writing by sealant manufacturer.
- E. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783.
 - 1. Field air leakage testing is not required for continuous curtain wall systems.
 - 2. Static-Air-Pressure Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
 - 3. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.
- F. Water Penetration: Test glazed aluminum curtain wall system for compliance with requirements according to AAMA 503, which requires testing according to ASTM E1105.
 - 1. Uniform Static-Air-Pressure Difference: 20 percent of positive design wind load, but not less than 479 Pa (10 psf). No uncontrolled water shall be present.
- G. Retesting:

1. Should system fail field test, system may be modified or repaired, and retested.
2. Should system fail second field test, system may be additionally modified or repaired, and retested.
3. All modifications and repairs made to tested areas shall be recorded, and same modifications and repairs made to all system and adjacent construction on project.
4. Should second test fail, Contracting Officer may require testing of additional areas of the curtain wall.

H. Rejection:

1. Failure of any of specimens to meet test requirements of third test shall be cause for rejection of wall system and adjacent construction on project.

3.8 PROTECTION

- A. After installation, protect windows, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

- - - END - - -

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Caulking: Section 07 92 00 JOINT SEALANTS.
- B. Application of Hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS Section 08 42 29, AUTOMATIC ENTRANCES, Section 08 71 13, AUTOMATIC DOOR OPERATORS
- C. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Painting: Section 09 91 00, PAINTING.
- E. Card Readers: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.
- F. Electrical: Division 26, ELECTRICAL.
- G. Fire Detection: Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 GENERAL

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

4. Exit devices.
5. Floor closers.

1.4 WARRANTY

- A. Automatic door operators shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:
1. Locks, latchsets, and panic hardware: 5 years.
 2. Door closers and continuous hinges: 10 years.

1.5 MAINTENANCE MANUALS

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

1.6 SUBMITTALS

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

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

- C. Samples and Manufacturers' Literature:

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

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

1.7 DELIVERY AND MARKING

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

1.8 PREINSTALLATION MEETING

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

1.9 INSTRUCTIONS

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

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

- B. Keying: All cylinders shall be keyed into existing VA key system by VA locksmith . Provide unkeyed removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 7 pin type. Specific keying information shall be furnished at a later date by the COR.

1.10 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.
- B. American Society for Testing and Materials (ASTM):
F883-04.....Padlocks
E2180-07.....Standard Test Method for Determining the
Activity of Incorporated Antimicrobial Agent(s)
In Polymeric or Hydrophobic Materials
- C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
A156.1-06.....Butts and Hinges
A156.2-03.....Bored and Pre-assembled Locks and Latches
A156.3-08.....Exit Devices, Coordinators, and Auto Flush
Bolts
A156.4-08.....Door Controls (Closers)
A156.5-01.....Auxiliary Locks and Associated Products
A156.6-05.....Architectural Door Trim
A156.8-05.....Door Controls-Overhead Stops and Holders
A156.12-05Interconnected Locks and Latches
A156.13-05.....Mortise Locks and Latches Series 1000
A156.14-07Sliding and Folding Door Hardware
A156.15-06.....Release Devices-Closer Holder, Electromagnetic
and Electromechanical
A156.16-08.....Auxiliary Hardware
A156.17-04Self-Closing Hinges and Pivots

A156.18-06.....Materials and Finishes
A156.20-06Strap and Tee Hinges, and Hasps
A156.21-09.....Thresholds
A156.22-05.....Door Gasketing and Edge Seal Systems
A156.23-04.....Electromagnetic Locks
A156.24-03.....Delayed Egress Locking Systems
A156.25-07Electrified Locking Devices
A156.26-06.....Continuous Hinges
A156.28-07Master Keying Systems
A156.29-07Exit Locks and Alarms
A156.30-03High Security Cylinders
A156.31-07Electric Strikes and Frame Mounted Actuators
A250.8-03.....Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):

80-10.....Fire Doors and Fire Windows
101-09.....Life Safety Code

E. Underwriters Laboratories, Inc. (UL):

Building Materials Directory (2008)

PART 2 - PRODUCTS

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2.1 BUTT HINGES

A. ANSI A156.1. Provide only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:

1. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less and Type A2111/A5111 for doors over 900 mm (3 feet) wide.
Hinges for exterior outswing doors shall have non-removable pins.
Hinges for exterior fire-rated doors shall be of stainless steel material.
2. Interior Doors: Type A8112/A5112 for doors 900 mm (3 feet) wide or less and Type A8111/A5111 for doors over 900 mm (3 feet) wide.
Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.

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

1. Doors up to 1210 mm (4 feet) high: 2 hinges.

2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
3. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.
4. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.
5. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
6. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
7. Provide heavy-weight hinges where specified.
8. At doors weighing 330 kg (150 lbs.) or more, furnish 127 mm (5 inch) high hinges.

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

2.2 CONTINUOUS HINGES

- A. ANSI/BHMA A156.26, Grade 1-600.
 1. Listed under Category N in BHMA's "Certified Product Directory."
- B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete
- C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 6.35mm (0.25-inch) minimum diameter pin that extends entire length of hinge.
 1. Base Metal for Exterior Hinges: Stainless steel.
 2. Base Metal for Interior Hinges: Stainless steel, Steel, Aluminum.
 3. Base Metal for Hinges for Fire-Rated Assemblies: Stainless steel or Steel.
 4. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
 5. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
 6. Provide with manufacturer's cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.

7. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
8. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer's adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.

2.3 DOOR CLOSING DEVICES

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

2.4 OVERHEAD CLOSERS

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

- drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
 11. Provide parallel arm closers with heavy duty rigid arm.
 12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
 13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
 14. All closers shall have a 1 ½" (38mm) minimum piston diameter.

2.6 DOOR STOPS

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Provide floor stops (Type L02141 or L02161 in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.
- E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.
- F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.
- G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.
- H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.

- I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.
- J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.
- K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.
- L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

2.7 OVERHEAD DOOR STOPS AND HOLDERS

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

2.8 FLOOR DOOR HOLDERS

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

2.9 LOCKS AND LATCHES

- A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than seven pins. Cylinders for all locksets shall be removable core type. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores.
- B. In addition to above requirements, locks and latches shall comply with following requirements:

1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2. All locksets and latchsets, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles fabricated from cast stainless steel. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance. All lock cases installed on lead lined doors shall be lead lined before applying final hardware finish. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on both sides of the opening, provide non-ferrous mortise lock case.
2. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)
3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.5.
4. Locks on designated doors in Psychiatric (Mental Health) areas shall be paddle type with arrow projection covers and be UL Listed. Provide these locks with paddle in the down position on both sides of the door. Locks shall be fabricated of wrought stainless steel.
5. Privacy locks in non-mental-health patient rooms shall have an inside thumbturn for privacy and an outside thumbturn for emergency entrance. Single occupancy patient privacy doors shall typically

swing out; where such doors cannot swing out, provide center-pivoted doors with rescue hardware (see HW-2B).

2.12 ELECTRIC STRIKES

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

2.13 KEYS

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

Locks/Keys	Quantity
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

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

- A. Conform to ANSI Standard A156.6.
- B. Provide protective plates as specified below:
 - 1. Kick plates, mop plates and armor plates of metal, Type J100 series.
 - 2. Provide kick plates and mop plates where specified. Kick plates shall be 254 mm (10 inches) or 305 mm (12 inches) high. Mop plates shall be 152 mm (6 inches) high. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick and mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.
 - 3. Kick plates and/or mop plates are not required on following door sides:
 - a. Armor plate side of doors;
 - b. Exterior side of exterior doors;
 - c. Closet side of closet doors;

- d. Both sides of aluminum entrance doors.
4. Armor plates for doors are listed under Article "Hardware Sets".
Armor plates shall be thickness as noted in the hardware set, 875 mm (35 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors. Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt push bar.
5. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick plate in place of armor plate. Size of stretcher plate and kick plate shall be 254 mm (10 inches) high.
6. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.

2.15 EXIT DEVICES

- A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have cast satin stainless steel lever handles of design similar to locksets, unless otherwise specified. Provide key cylinders for keyed operating trim and, where specified, cylinder dogging.
- B. Surface vertical rod panics shall only be provided less bottom rod; provide fire pins as required by exit device and door fire labels. Do not provide surface vertical rod panics at exterior doors.
- C. Concealed vertical rod panics shall be provided less bottom rod at interior doors, unless lockable or otherwise specified; provide fire pins as required by exit device and door fire labels. Where concealed

vertical rod panics are specified at exterior doors, provide with both top and bottom rods.

- D. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.
- E. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.
- F. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

2.16 FLUSH BOLTS (LEVER EXTENSION)

- A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.
- B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.
- C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).
- D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.
- E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

2.17 FLUSH BOLTS (AUTOMATIC)

- A. Conform to ANSI A156.3. Dimension of flush bolts shall conform to ANSI A115. Bolts shall conform to Underwriters Laboratories, Inc., requirements for fire door hardware. Flush bolts shall automatically latch and unlatch. Furnish dustproof strikes conforming to ANSI A156.16 for bottom flushbolt. Face plates for dustproof strike shall be rectangular and not less than 38 mm by 90 mm (1-1/2 by 3-1/2 inches).

2.18 DOOR PULLS WITH PLATES

- A. Conform to ANSI A156.6. Pull Type J401, 152 mm (6 inches) high by 19 mm (3/4 inches) diameter with plate Type J302, 90 mm by 350 mm (3-1/2 inches by 14 inches), unless otherwise specified. Provide pull with projection of 70 mm (2 3/4 inches) and a clearance of 51 mm (2 inches). Cut plates of door pull plate for cylinders, or turn pieces where required.

2.19 PUSH PLATES

- A. Conform to ANSI A156.6. Metal, Type J302, 200 mm (8 inches) wide by 350 mm (14 inches) high. Provide metal Type J302 plates 100 mm (4 inches

wide by 350 mm (14 inches) high) where push plates are specified for doors with stiles less than 200 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

2.20 COMBINATION PUSH AND PULL PLATES

- A. Conform to ANSI 156.6. Type J303, stainless steel 3 mm (1/8 inch) thick, 80 mm (3-1/3 inches) wide by 800 mm (16 inches) high), top and bottom edges shall be rounded. Secure plates to wood doors with 38 mm (1-1/2 inch) long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

2.21 COORDINATORS

- A. Conform to ANSI A156.16. Coordinators, when specified for fire doors, shall comply with Underwriters Laboratories, Inc., requirements for fire door hardware. Coordinator may be omitted on exterior pairs of doors where either door will close independently regardless of the position of the other door. Coordinator may be omitted on interior pairs of non-labeled open where open back strike is used. Open back strike shall not be used on labeled doors. Paint coordinators to match door frames, unless coordinators are plated. Provide bar type coordinators, except where gravity coordinators are required at acoustic pairs. For bar type coordinators, provide filler bars for full width and, as required, brackets for push-side surface mounted closers, overhead stops, and vertical rod panic strikes.

2.22 THRESHOLDS

- A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.
- B. For thresholds at elevators entrances see other sections of specifications.
- C. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.
- D. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) from frame face.

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

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

2.24 WEATHERSTRIPS (FOR EXTERIOR DOORS)

- A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length ($0.000774\text{m}^3/\text{s/m}$).

2.25 MISCELLANEOUS HARDWARE

- A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types):
Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E76213, conforming to ANSI A156.5. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.
- B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur. Provide cylinders to operate locking devices where specified for following partitions and doors:
 - 1. Folding doors and partitions.
 - 2. Wicket door (in roll-up door assemblies).
 - 3. Slide-up doors.
 - 4. Swing-up doors.
 - 5. Fire-rated access doors-Engineer's key set.
 - 6. Doors from corridor to electromagnetic shielded room.
 - 7. Day gate on vault door.
- C. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

2.26 PADLOCKS FOR VARIOUS DOORS, GATES AND HATCHES

- A. ASTM E883, size 50 mm (2 inch) wide chain; furnish extended shackles as required by job conditions. Provide padlocks, with key cylinders, for each door in following areas as noted.

B. Key padlocks as follows:

1. Chain Link Fence Gates for Electrical Substation and other Fenced Buildings or Areas: Engineer's set, except as otherwise specified.
2. Roof Access and Scuttles: Engineer's set.

2.27 THERMOSTATIC TEMPERATURE CONTROL VALVE CABINETS

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

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

- A. Butt hinges, type A8133 (special swaging) 100 mm by 90 mm (4 inches by 3-1/2 inches), Finish US2C.
 1. 3 hinges for guards over 1060 mm (3-1/2 feet) high.
 2. 2 hinges for guards less than 1060 mm (3-1/2 feet) high.
- B. Conform to ANSI A156.5. Lock Type E06081 for guards and Type E06061 for partitions.
 1. Keying: Except as noted otherwise, key locks like entrance door or space wherein guards and partitions are located except as otherwise specified.
 2. Key locks for partitions enclosing mechanical and electrical equipment in Engineer's Set. (See detailed drawings for number of locks and butt hinges required for each guard).

2.29 FINISHES

- A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.
- B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.
- C. Miscellaneous Finishes:
 1. Hinges --exterior doors: 626 or 630.
 2. Hinges --interior doors: 652 or 630.
 3. Pivots: Match door trim.

4. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
 5. Thresholds: Mill finish aluminum.
 6. Cover plates for floor hinges and pivots: 630.
 7. Other primed steel hardware: 600.
- E. Special Finish: Exposed surfaces of hardware for dark bronze anodized aluminum doors shall have oxidized oil rubbed bronze finish (dark bronze) finish on door closers shall closely match doors.

2.30 BASE METALS

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

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

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

- B. Hardware Heights from Finished Floor:
1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
 2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
 3. Deadlocks centerline of strike 1219 mm (48 inches).
 4. Hospital arm pull 1168 mm (46 inches) to centerline of bottom supporting bracket.
 5. Centerline of door pulls to be 1016 mm (40 inches).
 6. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
 7. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
 8. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

3.2 INSTALLATION

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

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

B. Hinge Size Requirements:

Door Thickness	Door Width	Hinge Height
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4-1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	125 mm (5 inches)
35 mm (1-3/8 inch) (hollow core wood doors)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

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

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

E. Hinges Required Per Door:

Doors 1500 mm (5 ft) or less in height	2 butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high	3 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts
Dutch type doors	4 butts
Doors with spring hinges 1370 mm (4 feet 6 inches) high or less	2 butts
Doors with spring hinges over 1370 mm (4 feet 6 inches)	3 butts

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

- G. After locks have been installed; show in presence of Contracting Officer Representative that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the Contracting Officer Representative for his records.)
- Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

3.3 FINAL INSPECTION

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

3.4 DEMONSTRATION

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

3.5 HARDWARE SETS

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

ELECTRIC HARDWARE ABBREVIATIONS LEGEND:

ADO = Automatic Door Operator

EMCH = Electro-Mechanical Closer-Holder

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

INTERIOR SINGLE DOORS

HW-5

Doors: 106A, 107, 108, 109

Each Door to Have:

RATED

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

HW-6

Door: 401

Each Door to Have:

RATED

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

EXTERIOR SINGLE DOORS

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HW-E4

Door: 305

Each Door to Have:

NON-RATED

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

HW-E5

Door: 106B

Each Roll-up Door to Have:

NON-RATED

1	Padlock or 2 Cylinders	TYPE AS REQUIRED
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BALANCE OF HARDWARE BY SECTION 08 36 13, SECTIONAL DOORS

EXTERIOR PAIRS OF DOORS

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HW-E10

Doors: 101, 301

Each Sliding Door to Have:

NON-RATED

1 Set Track Hardware TYPE REQUIRED FOR DOOR MATERIAL, WEIGHT,
AND MOUNTING DETAILS (COMPLETE WITH
TRACK, TRACK BRACKETS, HANGERS, GUIDES,
BUMPERS, AND INTERNAL TRACK STOPS)

2 Pulls TYPE AS REQUIRED

1 Sliding Door Lock E8281/E8291 (SLIDING DOOR LOCK)

2 Cylinder (for sliding dr lock)TYPE AS REQUIRED

Provide a fully functioning sliding door pair to integrate with SECTION 08
71 13, AUTOMATIC DOOR OPERATORS

- - - E N D - - -

SECTION 08 71 13
AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies equipment, controls and accessories for automatic operation of swing and sliding doors.

1.2 RELATED WORK

- A. Aluminum frames entrance work; Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- B. Door hardware; Section 08 71 00, DOOR HARDWARE.
- C. Section 28 13 00, ACCESS CONTROL.
- D. Glass and glazing of doors and frames; Section 08 80 00, GLAZING.
- E. Electric general wiring, connections and equipment requirements; Division 26, ELECTRICAL.
- F. Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 QUALITY ASSURANCE

- A. Automatic door operators, controls and other equipment shall be products of a manufacturer regularly engaged in manufacturing such equipment for a minimum of three years.
- B. One type of automatic door equipment shall be used throughout the building.
- C. Equipment installer shall have specialized experience and shall be approved by the manufacturer.

1.4 WARRANTY

- A. Automatic door operators shall be subject to the terms of the "Warranty of Construction", FAR clause 52.246-21, except that the Warranty period shall be two years in lieu of one year.

1.5 MAINTENANCE MANUALS

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on automatic door operators.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's literature and data describing operators, power units, controls, door hardware and safety devices.

C. Shop Drawings:

1. Showing location of controls and safety devices in relationship to each automatically operated door.
2. Showing layout, profiles, product components, including anchorage, accessories, as applicable.
3. Submit templates, wiring diagrams, fabrication details and other information to coordinate the proper installation of the automatic door operators.

- D. Submit in writing to COR that items listed in Article 1.3 are in compliance.

1.7 DESIGN CRITERIA

- A. As a minimum automatic door equipment shall comply with the requirements of BHMA 156.10. Except as otherwise noted on drawings, provide operators which will move the doors from the fully closed to fully opened position in three seconds maximum time interval, when speed adjustment is at maximum setting.
- B. Equipment: Conforming to UL 325. Provide key operated power disconnect wall switch for each door installation.
- C. Electrical Wiring, Connections and Equipment: Provide all motor, starter, controls, associated devices, and interconnecting wiring required for the installation. Equipment and wiring shall be as specified in Division 26, ELECTRICAL.

1.8 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. Builders Hardware Manufacturers Association, Inc. (BHMA):
A156.10-05.....Power Operated Pedestrian Doors (BHMA 1601)
- C. National Fire Protection Association (NFPA):
101-09.....Life Safety Code
- D. Underwriters Laboratory (UL):
325-10.....Door, Drapery, Gate, Louver, and Window
Operators and Systems

1.9 DELIVERY AND STORAGE

- A. Delivery shall be in factory's original, unopened, undamaged container with identification labels attached.

PART 2 - PRODUCTS

2.1 MICROPROCESSOR CONTROLS

- A. The system shall include a multi-function microprocessor control providing adjustable hold open time (1-30 seconds), LED indications for sensor input signals and operator status and power assist close options. Control shall be capable of receiving activation signals from any device with normally open dry contact output. All activation modes shall provide fully adjustable opening speed:
- B. The door shall be held open by low voltage applied to the continuous duty motor. The control shall include an adjustable safety circuit that monitors door operation and stops the opening direction of the door if an obstruction is sensed. The motor shall include a recycle feature that reopens the door if an obstruction is sensed at any point during the closing cycle. The control shall include a standard three position key switch with functions for ON, OFF, and HOLD OPEN, mounted on operator enclosure, door frame, or wall, as indicated in the architectural drawings.

2.2 SLIDING DOOR OPERATORS

- A. General: Sliding doors shall have electric operators, conforming to BHMA A156.10 and the following requirements as applicable. Assembly shall be single or bi-parting sliding doors as shown on drawings.
- B. Door Operation: Doors shall be opened by electric motor pulling door from closed to open position and shall stop door by electrically reducing voltage and stalling door against mechanical stop. System shall permit manual control of door in event of power failure. Opening and closing speeds shall be adjustable. In compliance with NFPA-101, all door panels shall allow "breakout" to the full open position to provide instant egress at any point in the door's movement.
- C. Operators: Completely assembled and sealed electromechanical operating unit, all located in cast aluminum housing and filled with special lubricant for extreme conditions. Attached to transmission system shall be a minimum 1/8 Hp "DC" shunt-wound permanent magnet motor with sealed ball bearings. Complete unit shall be rubber mounted with provisions

for easy maintenance and replacement. Operators shall have adjustable opening and closing cycle. Housing shall be minimum 6063T-5 alloy aluminum not less than .005 mm (125 inch) minimum thickness, 150 mm by 200 mm (6 inch wide by 8 inch high).

- D. Sliding Door Hardware Guide Rollers, Door Carrier: Top door carriers shall ride on steel or delrin rollers incorporating sealed bearings with each door having two support rollers and one anti-rise roller. Each roller shall have a minimum of 9 mm (3/8-inch) of vertical adjustment with positive mechanical locks. Each door shall also include two urethane covered oil impregnated bearing bottom rollers attached with 5 mm (3/16-inch) thick formed steel guide brackets. Each door carrier supporting a door leaf shall include a vertical steel reinforcing member to prevent sagging when door is swung under breakaway conditions. All carbon steel brackets and fittings shall be plated for corrosion resistance.
- E. Locking Hardware: Do not provide any locking hardware at all doors as these do not require physical security. Provide doors with flush concealed vertical rod panic hardware integrated into the doors where physical security is required and free egress is required at all times.
- F. Door Closers: Provide all breakout or swing-out panels with door closers concealed in the top rail of the door.

2.3 POWER UNITS

Each power unit shall be self-contained, electric operated and independent of the door operator. Capacity and size of power circuits shall be in accordance with automatic door operator manufacturer's specifications and Division 26 - ELECTRICAL.

2.4 DOOR CONTROLS

- A. Opening and closing actions of doors shall be actuated by motion detector controls and safety devices specified, and conform to ANSI 156.10. Controls shall cause doors to open instantly when control device is actuated; hold doors in open positions; then, cause doors to close, unless safety device or reactivated control interrupts operation.
- B. Motion Detector: The motion detector may be surface mounted or concealed, to provide a signal to actuate the door operator, and monitor the immediate zone, to detect intrusion by persons, carts or similar objects. The zone which the detector monitors shall be 1500 mm

(five feet) deep and 1500 mm (five feet) across, plus or minus 150 mm (six inches) on all dimensions. The maximum response time shall be no less than 25 milliseconds. Unit shall be designed to operate on 24 volts AC. The control shall not be affected by cleaning material, solvents, dust, dirt and outdoor weather conditions.

2.5 SAFETY DEVICES

- A. General: Area over which doors swing or slide shall be a safety section and anyone standing in path of door's movement shall be protected by a safety device.
- B. C. Time delay switches shall be adjustable between 3 to 60 seconds and shall control closing cycle of doors.
- D. Decals with sign "In" or "Do Not Enter" shall be installed on both faces of each door as coordinated with Designer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate installation of equipment with other related work. Manual controls and power disconnect switches shall be recessed or semi-flush mounted in partitions. Secure operator components to adjacent construction with suitable fastenings. Conceal conduits, piping, and electric equipment, in finish work.
- B. Install power units in locations shown. Where units are to be mounted on walls, provide metal supports or shelves for the units. All equipment, including time delay switches, shall be accessible for maintenance and adjustment.
- C. Operators shall be adjusted and must function properly for the type of traffic (pedestrians, carts, stretchers and wheelchairs) expected to pass through doors. Each door leaf of pairs of doors shall open and close in synchronization. On pairs of doors, operators shall allow either door to be opened manually without the other door opening.
- D. Install controls at positions shown and make them convenient for particular traffic expected to pass through openings. Maximum height of push plate wall switches from finished floors shall be 40 inches unless otherwise approved by the COR.

3.2 INSTRUCTIONS

- A. Following the installation and final adjustments of the door operators, the installer shall fully instruct VA personnel for 4 hours on the

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operating, servicing and safety requirements for the swing and sliding
automatic door operators.

B. Coordinate instruction to VA personnel with VA COR.

- - - E N D - - -

SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies glass, plastic, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

1.2 RELATED WORK

- A. Factory glazed by manufacturer in following units:
 - 1. Section 08 41 13, ALUMINUM FRAMED ENTRANCES AND STOREFRONTS.
 - 2. Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.
 - 3. Color of spandrel glass and tinted (heat absorbing or light reducing) glass: Section 09 06 00, SCHEDULE FOR FINISHES.
 - 3. Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.
 - 4. Section 28 16 11, INTRUSION DETECTION SYSTEM.

1.3 LABELS

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

1.4 PERFORMANCE REQUIREMENTS

- A. Building Enclosure Vapor Retarder and Air Barrier:
 - 1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
 - 2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

B. Glass Thickness:

1. Select thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7.
2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
3. Test in accordance with ASTM E 1300.
4. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

1.5 SUBMITTALS

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

B. Manufacturer's Certificates:

1. Certificates stating that wire glass, meets requirements for safety glazing material as specified in ANSI Z97.1.
2. Certificate on shading coefficient.
3. Certificate on "R" value when value is specified.
4. Certificate test reports confirming compliance's with specified bullet resistive rating.
5. Certificate that blast resistant glass meets the requirements of UFC4-010-01.

C. Warranty: Submit written guaranty, conforming to General Condition requirements, and to "Warranty of Construction" Article in this Section.

D. Manufacturer's Literature and Data:

1. Glass, each kind required.
2. Insulating glass units.
3. Glazing cushion.
4. Sealing compound.
5. Glazing cushion.

E. Samples:

1. Size: 150 mm by 150 mm (6 inches by 6 inches).
2. Tinted glass.

F. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.
- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.
- D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":
 - 2. Protect sealed-air-space insulating glazing units from exposure to abnormal pressure changes, as could result from substantial changes in altitude during delivery by air freight. Provide temporary breather tubes which do not nullify applicable warranties on hermetic seals.
 - 3. Temporary protections: The glass front and polycarbonate back of glazing shall be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces shall be approved and applied by manufacturer.
 - 4. Edge protection: To cushion and protect glass clad, polycarbonate, and Noviflex edges from contamination or foreign matter, the four edges shall be sealed the depth of glazing with continuous standard-thickness Santoprene tape. Alternatively, continuous channel shaped extrusion of Santoprene shall be used, with flanges extending into face sides of glazing.
 - 5. Protect "Constant Temperature" units including every unit where glass sheet is directly laminated to or directly sealed with metal-tube type spacer bar to polycarbonate sheet, from exposures to ambient temperatures outside the range of 16 to 24 C, during the

fabricating, handling, shipping, storing, installation, and
subsequent protection of glazing.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

1.8 WARRANTY

- A. Warranty: Conform to terms of "Warranty of Construction", FAR clause 52.246-21, except extend warranty period for the following:
1. Bullet resistive plastic material to remain visibly clear without discoloration.
 2. Insulating glass units to remain sealed for 10 years.
 3. Laminated glass units to remain laminated for 5 years.
 4. Polycarbonate to remain clear and ultraviolet light stabilized for 5 years.
 5. Insulating plastic to not have more than 6 percent decrease in light transmission and be ultraviolet light stabilized for 10 years.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
- Z97.1-09.....Safety Glazing Material Used in Building -
Safety Performance Specifications and Methods
of Test.
- C. American Society for Testing and Materials (ASTM):
- C542-05.....Lock-Strip Gaskets
- C716-06.....Installing Lock-Strip Gaskets and Infill
Glazing Materials.
- C794-10.....Adhesion-in-Peel of Elastomeric Joint Sealants
- C864-05.....Dense Elastomeric Compression Seal Gaskets,
Setting Blocks, and Spacers
- C920-11.....Elastomeric Joint Sealants
- C964-07.....Standard Guide for Lock-Strip Gasket Glazing
- C1036-06.....Flat Glass
- C1048-12.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated
and Uncoated Glass.

- C1376-10.....Pyrolytic and Vacuum Deposition Coatings on
Flat Glass
- D635-10.....Rate of Burning and/or Extent and Time of
Burning of Self-Supporting Plastic in a
Horizontal Position
- D4802-10.....Poly (Methyl Methacrylate) Acrylic Plastic
Sheet
- E84-10.....Surface Burning Characteristics of Building
Materials
- E119-10.....Standard Test Methods for Fire Test of Building
Construction and Material
- E2190-10.....Insulating Glass Unit
- D. Commercial Item Description (CID):
- A-A-59502.....Plastic Sheet, Polycarbonate
- E. Code of Federal Regulations (CFR):
- 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 2010
- F. National Fire Protection Association (NFPA):
- 80-13.....Fire Doors and Windows.
- 252-12.....Standard Method of Fire Test of Door Assemblies
- 257-12.....Standard on Fire Test for Window and Glass
Block Assemblies
- G. National Fenestration Rating Council (NFRC)
- H. Safety Glazing Certification Council (SGCC) 2012:
Certified Products Directory (Issued Semi-Annually).
- I. Underwriters Laboratories, Inc. (UL):
- 752-11.....Bullet-Resisting Equipment.
- J. Unified Facilities Criteria (UFC):
- 4-010-01-2012.....DOD Minimum Antiterrorism Standards for
Buildings
- K. Glass Association of North America (GANA):
Glazing Manual (Latest Edition)
Sealant Manual (2009)
- L. American Society of Civil Engineers (ASCE):
ASCE 7-10.....Wind Load Provisions

PART 2 - PRODUCT

2.1 GLASS

- A. Clear Glass:
1. ASTM C1036, Type I, Class 1, Quality q4.

2. Thickness, 6 mm (1/4 inch).
 3. Coordinate color/tint/coating to accommodate required security monitoring.
- C. Tinted Heat reflective and low emissivity coated glass:
1. ASTM C1036, Type I, Class 2, Quality q3.
 2. Color: As indicated in insulated glass units.
 3. Thickness, 6 mm (1/4 inch).

2.2 HEAT-TREATED GLASS

- A. Clear Heat Strengthened Glass:
1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.
 2. Thickness, 6 mm (1/4 inch).
- B. Tinted Heat Strengthened Glass:
1. ASTM C1048, Kind HS, Condition A, Type I, Class 2, Quality q3.
 2. Color: blue and bronze to match PPG Ideascapes.
 3. Thickness, 6 mm (1/4 inch).
- C. Clear Tempered Glass:
1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
 2. Thickness, 6 mm (1/4 inch).

2.3 LAMINATED GLASS

- A. Two or more lites of glass bonded with an interlayer material for use in building glazing
- B. Colored Interlayer:
1. Use color interlayer ultraviolet light color stabilization.
 2. Option: Use colored interlayer with clear glass in lieu of tinted glass and clear interlayer.
 3. Option: Use white interlayer with clear glass in lieu of obscure glass and clear interlayer.
 4. The interlayer assembly shall have uniform color presenting same appearance as tinted glass assembly.
- C. Use 1.5 mm (0.060 inch) thick interlayer for:
1. Horizontal or Sloped glazing.
 2. Acoustical glazing.
 3. Heat strengthened or fully tempered glass assemblies.
- D. Use min. 0.75 mm (0.030 inch) thick interlayer for vertical glazing where 1.5 mm (0.060 inch) interlayer is not otherwise shown or required.

2.4 LAMINATED GLAZING ASSEMBLIES

- A. Clear Glazing:
 - 1. Both panes clear glass ASTM C1036, Type I, Class 1, Quality q3.
 - 2. Thickness: Each pane, 3 mm (1/8 inch) thick.
- B. Clear Tempered Glazing:
 - 1. Both panes ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
 - 2. Thickness: Each pane 4.8 mm (3/16 inch) thick.
- C. Tinted Tempered Glazing:
 - 1. Exterior pane ASTM C1036, Type I, Class 3, Quality q3, 3 mm (1/8 inch) thick.
 - 2. Interior pane ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, 3 mm (1/8 inch) thick.
- D. Clear Heat Strengthened Glazing:
 - 1. Both panes, ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.
 - 2. Thickness: Each pane, 3 mm (1/8 inch) thick.
- E. Tinted Heat Strengthened Glazing:
 - 1. Both panes, ASTM C1048, Kind HS, Condition A, Type I, Class 2, Quality q3.
 - 2. Thickness: Each pane, 3 mm (1/8 inch) thick.

2.5 INSULATING GLASS UNITS

- A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space and comply with ASTM E2190.
- B. Assemble units using glass types specified:
- C. Sealed Edge Units (SEU):
 - 1. Basis of Design: SunGuard Super Neutral 54 Crystal Gray
 - 2. Insulating Glass Unit Makeup
 - a. Outboard Lite
 - 1. Glass type: Plain
 - 2. Glass Tint: Clear
 - 3. Nominal Thickness: 1/4"
 - 4. Glass Strength: (as indicated)
 - 5. Coating Orientation: Surface #2
 - b. Spacer
 - 1. Nominal Thickness: 1/2"

2. Gas Fill: Air
- c. Inboard Lite
 1. Glass Type: Plain
 2. Glass Tint: blue or bronze PPG Ideascapes. See architectural drawings for color location
 3. Nominal Thickness: 1/4"
 4. Glass Strength: (as indicated)
 5. Coating Orientation: (N/A)
3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.
- D. Fused Edge Units, (FEU):
 1. Glass to glass sealed edges electrically fused.
 2. Air space not less than 4.8 mm (3/16 inch) wide up to 6 mm (1/4 inch) wide.
 3. R value not less than 1.5.
- E. FEU Clear Glass.
 1. Interior and exterior panes, ASTM C1036, Type I, Class 1, Quality q3, 3 mm (1/8 inch) thick.
 2. Thickness, 11 mm (7/16 inch) minimum.

2.6 GLAZING ACCESSORIES

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.
- B. Setting Blocks: ASTM C864:
 1. Channel shape; having 6 mm (1/4 inch) internal depth.
 2. Shore a hardness of 80 to 90 Durometer.
 3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.
 4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
 5. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.
- C. Spacers: ASTM C864:
 1. Channel shape having a 6 mm (1/4 inch) internal depth.

2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.

3. Lengths: One to 25 to 76 mm (one to three inches).

4. Shore a hardness of 40 to 50 Durometer.

D. Sealing Tapes:

1. Semi-solid polymeric based material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.

2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.

E. Glazing Gaskets: ASTM C864:

1. Firm dense wedge shape for locking in sash.

2. Soft, closed cell with locking key for sash key.

3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.

F. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.

G. Glazing Sealants: ASTM C920, silicone neutral cure:

1. Type S.

2. Class 25

3. Grade NS.

4. Shore A hardness of 25 to 30 Durometer.

H. Structural Sealant: ASTM C920, silicone acetoxo cure:

1. Type S.

2. Class 25.

3. Grade NS.

4. Shore a hardness of 25 to 30 Durometer.

I. Color:

1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.

2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.

J. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units intended for removal for smoke control. Comply with requirements of local Fire Department.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer's approved shop drawings.

B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation: Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

3.2 PREPARATION

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.
- C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.
- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION - GENERAL

- A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.
- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.

G. Laminated Glass:

1. Tape edges to seal interlayer and protect from glazing sealants.
2. Do not use putty or glazing compounds.

H. Insulating Glass Units:

1. Glaze in compliance with glass manufacturer's written instructions.
2. When glazing gaskets are used, they shall be of sufficient size and depth to cover glass seal or metal channel frame completely.
3. Do not use putty or glazing compounds.
4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.
5. Install with tape or gunnable sealant in wood sash.

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

- A. Cut glazing tape to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Trim protruding tape edge.

3.5 REPLACEMENT AND CLEANING

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by Contracting Officer Representative.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

3.6 PROTECTION

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

3.7 GLAZING SCHEDULE

A. Tempered Glass:

1. Install in full and half glazed doors unless indicated otherwise.

2. Install in storefront, windows, and door sidelights adjacent to doors.
 3. Use tempered glass of color indicated on interior side lights and doors, and on exterior doors and sidelights unless otherwise indicated or specified.
- B. Tinted Glass: Exterior pane of dual glazed windows not receiving tinted tempered glass as indicated in the architectural drawings.
- C. Laminated Glass: Install as specified in doors and interior pane of dual glazed windows where indicated.
1. If laminated glass is required for double glazed windows, provide it for interior panes only.

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SECTION 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies fixed and operable wall louvers, door louvers and wall vents.

1.2 RELATED WORK

- A. Louvers in steel doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- B. Color of finish: Section 09 06 00, SCHEDULE FOR FINISHESS.
- C. Louvers in lead lined wood doors: Section 13 49 00, RADIATION PROTECTION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
Each type, showing material, finish, size of members, method of assembly, and installation and anchorage details.
- C. Manufacturer's Literature and Data:
Each type of louver and vent.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The Master Painters Institute (MPI):
Approved Product List - September 2011
- C. American Society for Testing and Materials (ASTM):
A167-99(R2009).....Stainless and Heat-Resisting Chromium - Nickel Steel Plate, Sheet, and Strip
A1008/A1008M-10.....Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability
B209/B209M-03(R2007)....Aluminum and Aluminum Alloy, Sheet and Plate
B221-08.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
B221M-07.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Shapes, and Tubes
- D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06.....Metal Finishes Manual
LOUVERS AND VENTS

- E. National Fire Protection Association (NFPA):
90A-09.....Installation of Air Conditioning and Ventilating
Systems
- F. American Architectural Manufacturers Association (AAMA):
2605-11.....High Performance Organic Coatings on
Architectural Extrusions and Panels
- G. Air Movement and Control Association, Inc. (AMCA):
500-L-07.....Testing Louvers

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Stainless Steel: ASTM A167, Type 302B.
- C. Carbon Steel: ASTM A1008/A1008M.
- D. Aluminum, Plate and Sheet: ASTM B209/B209M.
- E. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or shown, shall be toggle or expansion bolts, of size and type as required for each specific type of installation and service condition.
1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
 2. Fasteners for louvers, louver frames, and wire guards shall be of stainless steel or aluminum.
- F. Inorganic Zinc Primer: MPI No. 19.

2.2 EXTERIOR WALL LOUVERS

- A. General:
1. Provide fixed type louvers of size and design shown.
 2. Heads, sills and jamb sections shall have formed caulking slots or be designed to retain caulking. Head sections shall have exterior drip lip, and sill sections an integral water stop.
 3. Furnish louvers with sill extension or separate sill as shown.
 4. Frame shall be mechanically fastened or welded construction with welds dressed smooth and flush.
- B. Performance Characteristics:
1. Weather louvers shall have a minimum of 55 percent free area and shall pass 980 free area velocity at a pressure drop not exceeding .11 inch water gage and carry not more than .01ounces of water per

LOUVERS AND VENTS

square foot of free area for 15 minutes when tested per AMCA Standard 500-L.

2. Louvers shall bear AMCA certified rating seals for air performance and water penetration ratings.

C. Aluminum Louvers:

1. General: Frames, blades, and mullions (sliding interlocking type); 2 mm (0.081-inch) thick extruded aluminum. Blades shall be standard type and have reinforcing bosses.
2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames shall not exceed 1700 mm (66 inches) wide. When openings exceed 1700 mm (66 inches), provide twin louvers separated by mullion members.

2.3 EXTERIOR DOOR LOUVERS

- A. Fabricate of 1.6 mm (0.063-inch) thick extruded aluminum. Miter frames at corners and join by concealed corner brackets.
- B. Equip louvers on outside with wire guards, except omit wire guards for louvers in doors located completely below enclosed areaways.

2.4 AIR INTAKE VENTS

- A. Fabricate exterior louvered wall ventilators for fresh air intake for air conditioning units from extruded aluminum, ASTM B221. Form with integral horizontal louvers and frame, with drip extending beyond face of wall and integral water stops.
- B. Provide 0.8 m (0.032-inch) thick aluminum sleeves where shown.

2.5 BRICK VENTS

- A. Vents shall be of size shown formed of approximately 3 mm (0.125 inch) thick cast aluminum, or 3 mm (0.125) inch extruded aluminum.
- B. Provide vents complete with aluminum screen frame with corrosion resistant insect screening mounted on back of vent.
- C. Provide vents with required anchors.

2.6 FINISH

- A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505
- B. Aluminum Louvers
 1. Anodized finish
 - a. Mill finish, as fabricated.
- C. Aluminum Wall Vents and Brick Vents: Sand blasted satin finish.
- D. Stainless Steel: Mechanical finish No. 4 in accordance with NAAMM Metal Finishes Manual.

LOUVERS AND VENTS

089000

- E. Sheet Steel: Baked-on or oven dried shop prime coat.
 - 1. Paint interior surfaces of lightproof louvers with two additional finish shop coats of baked-on flat black enamel.
 - 2. Finish painting of exposed surfaces of shop primed louvers is specified in Section 09 91 00, PAINTING.
- F. Steel: Surfaces of steel work, for which no other finish is specified, shall be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication, except ferrous metals concealed in finished work. Paint all contact surfaces of assembled work (except welded contact surfaces) with an additional shop coat of similar paint.

2.7 PROTECTION

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.
- B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.
- C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.
- C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers and vents to building construction as specified. Power actuated drive pins shall be used, except for removal items and where members would be deformed or substrate damaged by their use.
- D. Generally, set wall louvers and vents in masonry walls during progress of the work. If wall louvers and vents are not delivered to job in time

for installation in prepared openings, make provision for later installation. Set in cast-in-place concrete in prepared openings.

3.2 CLEANING AND ADJUSTING

- A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum shall be cleaned as recommended by the manufacturer and protected from damage until completion of the project.
- B. All movable parts, including hardware, shall be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components

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**SECTION 09 06 00
SCHEDULE FOR FINISHES**

SECTION 09 06 00-SCHEDULE FOR FINISHES

VAMC: Salisbury VAMC
Location: Salisbury, NC 28144
Project no. 246-13-C-0124 and Name: Construct New Parking Garage
Submission: 99% CONSTRUCTION DOCUMENTS, NOT FOR CONSTRUCTION
Date: June 16, 2014

SECTION 09 06 00
SCHEDULE FOR FINISHES

PART I - GENERAL

1.1 DESCRIPTION

This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

1.2 MANUFACTURERS

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

1.3 SUBMITALS

Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES—provide quadruplicate samples for color approval of materials and finishes specified in this section.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. Precast/Prestressed Concrete Institute (PCI)
2014..... Color and Texture Selection Guide
- C. MASTER PAINTING INSTITUTE: (MPI)
2001.....Architectural Painting Specification Manual

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PART 2- PRODUCTS

2.3 DIVISION 03 - CONCRETE

A. SECTION 03 30 00, CAST IN PLACE CONCRETE

Surface	Finish Description
HONED	PENETRATING STAIN, PT-3

B. SECTION 03 45 00, PRECAST ARCHITECTURAL CONCRETE

Contractor to provide samples for selection that are similar in appearance to the range of PCI colors indicated. The two precast concrete finishes to be distinctly different from each other and complementary in shading.

Finish Designation	Color	Concrete Color	Texture	Exposure	PCI Color No.
PC-1	Buff/Tan	White	Sandblasted	Light	111, 109, 113, 119, 123, 143, 157 or 252
PC-3	Brown	70% Gray 30% White	Acid Etched	Light	189, 215, 244, 262, 311, or 494\

2.4 DIVISION 04 - MASONRY

A. Section 04 05 13, MASONRY MORTARING and Section 04 05 16, MASONRY GROUTING

Finish Code	Manufacturer	Mfg. Color Name
--	TBD	Standard Gray

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B. Section 04 20 00, UNIT MASONRY

1. FACE BRICK (FB)				
Finish Code	Size	Pattern	Manufacturer	Mfg. Color Name/No.
PCW	UTILITY	RUNNING BOND	TAYLOR CLAY BRICK	RED RANGE

3.CONCRETE MASONRY UNIT (CMU)				
Finish Code	Size	Pattern	Finish	Mfg. Color Name/No.
CMU	8 x 8 x 16	RUNNING BOND	PT-8 Where indicated on drawings	TBD
CMU	8 x 8 x 16	RUNNING BOND	STANDARD GRAY	TBD

2.5 DIVISION 05 - METALS

A. SECTION 05 12 00, STRUCTURAL STEEL FRAMING

Component	Finish	Color
EXPOSED STRUCTURAL STEEL	PAINT	PT-1

B. SECTION 05 31 00, STEEL DECKING, SECTION 05 36 00, COMPOSITE METAL DECKING

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Finish	Color
EXPOSED STRUCTURAL STEEL	PT-1

C. SECTION 05 50 00, METAL FABRICATION

Item	Finish
Channel Door Frames	PT-1
Structural Steel Angle Corner Guards	PT-9
Guard Angles for Overhead Doors	PT-1
Edge Guards Angles for Opening in Slabs	PT-7
Steel Grating and Frames	PT-7
Aluminum Gratings and Frames	ANOD. ALUM.
MESH WIRE PANEL(MWP-1)	PT-1
MESH WIRE PANEL (MWP-2)	PT-1
Aluminum Plate Door Sill	ANOD. ALUM.
Aluminum Safety Nosing	ANOD. ALUM.
Steel Ladders	PT-7
Steel Pipe Railings and Gates (not on Steel Stairs)	PT-7
Floor Trap Door and Ceiling Hatch	PT-7

D. SECTION 05 70 00, WIRE METAL MESH

Color	Manufacturer	Mfg. Color Name/No.
WHITE		WHITE

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2.6 DIVISION 06 WOOD, PLASTICS, AND COMPOSITES

As Specified

2.7 DIVISION 07 - THERMAL AND MOISTURE PROTECTION

A. SECTION 07 40 00, ROOFING AND SIDING PANELS

Type	Shape	Ext. Finish	Int. Finish	Manufacturer	Mfg. Color Name/No.

B. SECTION 07 54 23, THERMOPLASTIC POLYOLEFIN ROOFING (TPO)

Color	Manufacturer	Mfg. Color Name/No.
WHITE		WHITE

C. SECTION 07 18 13, PEDESTRIAN TRAFFIC COATINGS

As Per Drawings

D. SECTION 07 60 00, FLASHING AND SHEET METAL

Item	Material	Finish
Copings		
	Stainless steel	WHITE
	Aluminum	WHITE
Hanging Gutters and Downspouts		
	Stainless steel	WHITE

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	Aluminum	WHITE
Roof Insulated Expansion Joint Covers	Vinyl sheet	
Gravel Stops	Aluminum mill	WHITE
	Aluminum	WHITE
		WHITE
	Stainless steel	WHITE
Scuppers		WHITE

E. SECTION 07 71 00 / 07 72 00, ROOF SPECIALITIES AND ACCESSORIES

Item	Material	Finish	Manufacturer	Manufacturer/Color Name/Number.
Roof Hatch	Aluminum	Mill		
Equipment Support	Galv. Steel	Paint		
Copings	Extruded Aluminum	MILL, PRE-FINISHED		WHITE
Gravel Stops and Fascia System	Extruded Aluminum	MILL, PRE-FINISHED		WHITE
Fascia Systems	Extruded Aluminum	MILL, PRE-FINISHED		LIGHT BEIGE
Roof Expansion Joint Covers	Extruded Aluminum	Mill		WHITE

F. SECTION 07 92 00, JOINT SEALANTS

Location	Color	Manufacturer	Manufacturer Color
Masonry Expansion Joints	LIGHT BEIGE		
CMU Control Joints	LIGHT BEIGE		

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Precast Concrete Panels	BEIGE		
Building Expansion Joints	LIGHT BEIGE OR WHITE		
Masonry Sealed Joints	BEIGE		

G. SECTION 07 95 13, EXPANSION JOINT COVER ASSEMBLIES

	Material	Finish	Manufacturer	Mfg. Color Name/No.
Floor Component Cover Plate Frame Casket or Sealant (interior only)	ALUM	CLEAR ANOD. ALUM	xxx	xxx
Wall Component Cover Plate Frame Casket or Sealant (interior only)	PRE-FINISHES METAL	MATCH PT-2, WHISPER BLUFF #A1765	xxx	xxx
Ceiling Component Cover Plate, Gasket or Sealant (interior only)	PRE-FINISHED METAL	PT-1, WHITE	xxx	xxx
Exterior Wall Cover Plate Frame Thermoplastic Joint	PRE-FINISHES METAL	MATCH PT-2, WHISPER BLUFF #A1765	xxx	xxx

2.8 DIVISION 08 - OPENINGS

A. SECTION 08 11 13, HOLLOW METAL DOORS AND FRAMES

Paint both sides of door and frames same color including ferrous metal louvers, and hardware attached

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to door	
Component	Color of Paint Type and Gloss
Door	PT-1
Frame	PT-1
Window frame	WHITE

B. SECTION 08 31 13, ACCESS DOORS AND FRAMES

Material	Finish/Color
Steel	PT-2
Stainless steel	PT-2

C. SECTION 08 36 13, SECTIONAL DOORS

Finish	Manufacturer	Manufacturer Color Name/No.
PAINT	MILL	PT-2

D. SECTION 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

Material	Finish	Manufacturer	Manufacturer Color Name/No.
Aluminum	CLEAR ANOD. ALUM	MILL	CLEAR ANOD.
Glass	GRAY	PPG	SOLARGRAY

F. SECTION 08 80 00, GLAZING

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Glazing Type	Manufacturer	Mfg. Color Name/No.
G-1	PPG	SOLARGRAY 70XL

G. SECTION 08 44 13, GLAZED ALUMINUM CURTAIN WALLS

Component	Material	Finish	Manufacturer	Mfg. Color Name/No.
Frame	ALUM.	CLEAR ANOD.		CLEAR ANOD. ALUM.
Glazing	GL	GRAY	PPG	SOLARGRAY 70XL
Standard Panel				

2.9 DIVISION 09 - FINISHES

A. SECTION 09 30 13, CERAMIC TILING

1. CERAMIC MOSAIC TILE (FT)					
Color	Size	Shape	Pattern	Manufacturer	Mfg. Color Name/No.

B. SECTION 09 51 00, ACOUSTICAL CEILINGS

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C. SECTION 09 54 23, LINEAR METAL CEILINGS (LMC)

Finish Code	Strip Material	Strip Face Size	Manufacturer	Mfg Name/No.	Finish
LMC	METAL	8"	ARMSTRONG	METALWORKS EXTERIOR LINEAR	PT-1

T. SECTION 09 91 00, PAINT AND COATINGS

1. MPI Gloss and Sheen Standards

		Gloss @60	Sheen @85
Gloss Level 1	a traditional matte finish-flat	max 5 units, and	max 10 units
Gloss Level 2	a high side sheen flat-"a velvet-like" finish	max 10 units, and	10-35 units
Gloss Level 3	a traditional "egg-shell like" finish	10-25 units, and	10-35 units
Gloss Level 4	a "satin-like" finish	20-35 units, and	min. 35 units
Gloss Level 5	a traditional semi-gloss	35-70 units	
Gloss Level 6	a traditional gloss	70-85 units	
Gloss level 7	a high gloss	more than 85 units	

2. Paint code	Gloss	Manufacturer	Mfg. Color Name/No.
PT-1	SATIN	GLIDDEN	WHITE
PT-2	SATIN	GLIDDEN	WHISPER BLUFF
PT-3	SATIN	GLIDDEN	BASIC KHAKI
PT-4	SATIN	GLIDDEN	BLUE BLOOD
PT-5	SATIN	GLIDDEN	OLD FLAME
PT-6	SATIN	GLIDDEN	PEKING ORANGE

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PT-7	SATIN	GLIDDEN	OLD MONTEREY
PT-8	SATIN	GLIDDEN	BROWN STUDY

2.10 DIVISION 10 - SPECIALTIES

A. SECTION 08 90 00, LOUVERS AND WALL VENTS

Item	Material	Finish	Manufacturer	Mfg. Color Name/No.
	SHOP PRIMED METAL	PT-1	GLIDDEN	WHITE

I. SECTION 10 13 00 / 10 14 00, EXTERIOR SIGNS

As per drawings

J. SECTION 10 13 00 / 10 14 00, INTERIOR SIGNS

As per drawings

K. SECTION 10 44 13, FIRE EXTINGUISHER CABINETS

Component	Material	Finish

L. SECTION 10 22 13, WIRE MESH PARTITIONS

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Room No. and Name	Paint Code

2.11 DIVISION II - EQUIPMENT

A. SECTION 11 12 00, PARKING CONTROL EQUIPMENT

Component	Material	Manufacturer	Mfg. Color Name/No.
Ticket Dispenser			
Gate and Arm			
Booth Exterior			
Booth Interior			
Booth Shelf			

2.12 DIVISION 12- FURNISHINGS

A. SECTION 12 31 00, METAL CASEWORK

B. SECTION 12 32 00, WOOD CASEWORK

C. SECTION 12 36 00, COUNTERTOPS AND ACCESSORIES

D. SECTION 12 34 00, MOLDED PLASTIC CASEWORK

E. SECTION 12 22 16, DRAPERY HARDWARE

F. SECTION 12 24 00, WINDOW SHADES

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G. SECTION 12 24 21, LIGHTPROOF SHADES

H. SECTION 12 56 70.11, SUSPENDED TABLE

2.13 DIVISION 13 - SPECIAL CONSTRUCTION

A. SECTION 11 41 21 / 11 53 23 / 11 78 13, WALK - IN REFRIGERATORS AND FREEZERS

B. SECTION 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON STRUCTURAL COMPONENTS

C. SECTION 13 34 19, PRE ENGINEERED METAL BUILDINGS

D. SECTION 22 12 16, ELEVATED WATER TANK

E. SECTION 13 17 23.11, THERAPEUTIC POOL ACCESSORIES

F. SECTION 14 21 00, ELECTRIC TRACTION ELEVATORS

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Construct New Parking Garage
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Elevator	Component	Material	Finish	Color
Passenger Elevator No. P	Hoistway Entrance			
	Hoistway Doors			
	Corridor Position Indicator and Call Buttons			
	Car Canopy	Steel		
	Car Wainscot	Stainless Steel		
	Panels Above Wainscot	Plastic Laminate		
	Car Floor			
	Car Operating Panel			
Freight Elevator No. F	Car Enclosure	Steel		
	Car Floor	Steel		
	Car Gate	Wire Mesh		
	Rubbing Strip	Wood		
	Hoistway Entrances	Steel		
	Hoistway Doors	Steel		

2.15 DIVISION 22 - PLUMBING

A. SECTION 22 40 00, PLUMBING FIXTURES AND TRIM

Item	Color
Service Sink	

2.16 DIVISON 26 - ELECTRICAL

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Salisbury, NC 28144

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A. SECTION 26 51 00, BUILDING LIGHTING INTERIOR

Fixture Type	Exterior Finish	Color

B. SECTION 26 56 00, SITE LIGHTING

Type and Component	Exterior Finish	Manufacturer	Mfg. Name/No.

C. SECTION 10 25 13, PATIENT BED SERVICE WALLS

Component	Material	Finish	Manufacturer	Mfg. Color/Name
Cabinet Frame				
Face Panel				
Doors				

PART III EXECUTION

3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS

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FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS	
Term	Abbreviation
Access Flooring	AF
Accordion Folding Partition	AFP
Acoustical Ceiling	AT
Acoustical Ceiling, Special Faced	AT (SP)
Acoustical Metal Pan Ceiling	AMP
Acoustical Wall Panel	AWP
Acoustical Wall Treatment	AWT
Acoustical Wallcovering	AWF
Anodized Aluminum Colored	AAC
Anodized Aluminum Natural Finish	AA
Baked On Enamel	BE
Brick Face	BR
Brick Flooring	BF
Brick Paving	BP
Carpet	CP
Carpet Athletic Flooring	CAF
Carpet Module Tile	CPT
Ceramic Glazed Facing Brick	CGFB
Ceramic Mosaic Tile	FTCT
Concrete	C
Concrete Masonry Unit	CMU
Divider Strips Marble	DS MB
Epoxy Coating	EC
Epoxy Resin Flooring	ERF

Existing	E
Exposed Divider Strips	EXP
Exterior	EXT
Exterior Finish System	EFS
Exterior Paint	EXT-P
Exterior Stain	EXT-ST
Fabric Wallcovering	WF
Facing Tile	SCT
Feature Strips	FS
Floor Mats & Frames	FM
Floor Tile, Mosaic	FT
Fluorocarbon	FC
Folding Panel Partition	FP
Foot Grille	FG
Glass Masonry Unit	GUMU
Glazed Face CMU	GCMU
Glazed Structural Facing Tile	SFTU
Granite	GT
Gypsum Wallboard	GWB
High Glazed Coating	SC
Latex Mastic Flooring	LM
Linear Metal Ceiling	LMC
Linear Wood Ceiling	LWC
Marble	MB
Material	MAT
Mortar	M
Multi-Color Coating	MC
Natural Finish	NF
Paint	P
Paver Tile	PVT
Perforated Metal Facing (Tile or Panels)	PMF
Plaster	PL
Plaster High Strength	HSPL
Plaster Keene Cement	KC

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Plastic Laminate	HPDL
Polypropylene Fabric Wallcovering	PFW
Porcelain Paver Tile	PPT
Quarry Tile	QT
Radiant Ceiling Panel System	RCP
Resilient Stair Tread	RST
Rubber Base	RB
Rubber Tile Flooring	RT
Spandrel Glass	SLG
Stain	ST
Stone Flooring	SF
Structural Clay	SC
Suspension Decorative Grids	SDG
Terrazzo Portland Cement	PCT

Terrazzo Tile	TT
Terrazzo, Thin Set	
Textured Gypsum Ceiling Panel	TGC
Textured Metal Ceiling Panel	TMC
Thin set Terrazzo	TST
Veneer Plaster	VP
Vinyl Base	VB
Vinyl Coated Fabric Wallcovering	W
Vinyl Composition Tile	VCT
Vinyl Sheet Flooring	VSF
Vinyl Sheet Flooring (Welded Seams)	WSF
Wall Border	WB
Wood	WD

3.2 FINISH SCHEDULE SYMBOLS

Symbol Definition

** Same finish as adjoining walls
- No color required
E Existing
XX To match existing
EFTR Existing finish to remain
RM Remove

3.3 ROOM FINISH SCHEDULE

--- E N D---

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Load bearing framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.
- C. Pull down tabs in steel decking: Section 05 36 00, COMPOSITE METAL DECKING.
- D. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS Section 09 29 00, GYPSUM BOARD.

1.3 TERMINOLOGY

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Studs, runners and accessories.
 - 2. Hanger inserts.
 - 3. Channels (Rolled steel).
 - 4. Furring channels.
 - 5. Screws, clips and other fasteners.
- C. Shop Drawings:
 - 1. Typical ceiling suspension system.
 - 2. Typical metal stud and furring construction system including details around openings and corner details.

3. Typical shaft wall assembly

4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.

D. Test Results: Fire rating test designation, each fire rating required for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

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

B. American Society For Testing And Materials (ASTM)

A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire

C11-10.....Terminology Relating to Gypsum and Related
Building Materials and Systems

C635-07.....Manufacture, Performance, and Testing of Metal
Suspension System for Acoustical Tile and Lay-in
Panel Ceilings

C636-08.....Installation of Metal Ceiling Suspension Systems
for Acoustical Tile and Lay-in Panels

C645-09.....Non-Structural Steel Framing Members

C754-11.....Installation of Steel Framing Members to Receive
Screw-Attached Gypsum Panel Products

C841-03(R2008).....Installation of Interior Lathing and Furring

C954-10.....Steel Drill Screws for the Application of Gypsum
Panel Products or Metal Plaster Bases to Steel
Studs from 0.033 in. (0.84 mm) to 0.112 in.
(2.84 mm) in Thickness

E580-11.....Application of Ceiling Suspension Systems for
Acoustical Tile and Lay-in Panels in Areas
Requiring Moderate Seismic Restraint.

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

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

2.2 STEEL STUDS AND RUNNERS (TRACK)

A. ASTM C645, modified for thickness specified and sizes as shown.

1. Use ASTM A525 steel, 0.8 mm (0.0329-inch) thick bare metal (33 mil).
2. Runners same thickness as studs.
- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
- E. Shaft Wall Framing:
 1. Conform to rated wall construction.
 2. C-H Studs.
 3. E Studs.
 4. J Runners.
 5. Steel Jamb-Strut.

2.3 FURRING CHANNELS

- A. Rigid furring channels (hat shape): ASTM C645.
- B. Resilient furring channels:
 1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
 2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
- C. "Z" Furring Channels:
 1. Not less than 0.45 mm (0.0179-inch)-thick bare metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
 2. Web furring depth to suit thickness of insulation with slotted perforations.
- D. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.

- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- F. Tie Wire and Hanger Wire:
 - 1. ASTM A641, soft temper, Class 1 coating.
 - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:
 - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
 - 2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.
- H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

- A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.
- B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 610 mm (24 inches) on center.
- C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.
- D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.
- G. Openings:
 - 1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.

2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.

H. Fastening Studs:

1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

I. Chase Wall Partitions:

1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

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

K. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. Wall furring-Stud System:

1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.
2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:

1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.

3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
 4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
 5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
 6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.
- D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

3.7 TOLERANCES

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

- - - E N D - - -

SECTION 09 30 13
CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies ceramic tile, waterproofing membranes for thin-set applications, crack isolation membranes for flooring located in elevator cabs.

1.2 RELATED WORK

- A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS.
- B. Color, texture and pattern of field tile and trim shapes, size of field tile, and color of grout specified: Section 09 06 00, SCHEDULE FOR FINISHES and as indicated on the architectural drawings.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Porcelain tile, each type, color, patterns and size.
- C. Product Data:
 - 1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
 - 2. Chemical resistant mortar and grout (Epoxy and Furan).
 - 3. Dry-set Portland cement mortar and grout.
 - 4. Elastomeric membrane and bond coat.
 - 5. Reinforcing tape.
 - 6. Latex-Portland cement mortar and grout.
 - 7. Commercial Portland cement grout.
 - 8. Slip resistant tile.
 - 9. Fasteners.
- D. Certification:
 - 1. Master grade, ANSI A137.1.
 - 2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
 - a. Chemical resistant mortar and grout (epoxy and furan).
 - b. Modified epoxy emulsion.
 - c. Commercial Portland cement grout.
 - d. Cementitious backer unit.
 - e. Dry-set Portland cement mortar and grout.
 - f. Elastomeric membrane and bond coat.

- g. Reinforcing tape.
- h. Latex-Portland cement mortar and grout.
- i. Leveling compound.
- j. Organic adhesive.
- k. Waterproof isolation membrane.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
 - A108.1A-11.....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
 - A108.1B-11.....Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar
 - A108.1C-11.....Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar
 - A137.1-08.....Ceramic Tile
- C. American Society For Testing And Materials (ASTM):
 - A185-07.....Steel Welded Wire Fabric, Plain, for Concrete Reinforcing
 - C109/C109M-11.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)
 - C241-09.....Abrasion Resistance of Stone Subjected to Foot Traffic
 - C348-08.....Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
 - C627-10.....Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
 - C954-11.....Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from

- 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness
- C979-10.....Pigments for Integrally Colored Concrete
- C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Panel Products
- C1027-09.....Determining "Visible Abrasion Resistance on Glazed Ceramic Tile"
- C1028-07.....Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method
- C1127-09.....Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface
- C1178/C1178M-11.....Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
- C1325-08.....Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
- D4397-10.....Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
- D5109-99(R2004).....Standard Test Methods for Copper-Clad Thermosetting Laminates for Printed Wiring Boards
- D. Marble Institute of America (MIA): Design Manual III-2007
- E. Tile Council of America, Inc. (TCA):
2007.....Handbook for Ceramic Tile Installation

PART 2 - PRODUCTS

2.1 TILE

- A. Comply with ANSI A137.1, Standard Grade, except as modified:
1. Inspection procedures listed under the Appendix of ANSI A137.1.
 2. Abrasion Resistance Classification:
 - a. Tested in accordance with values listed in Table 1, ASTM C 1027.
 - b. Class V, 12000 revolutions for floors in Corridors, Kitchens, Storage including Refrigerated Rooms
 - c. Class IV, 6000 revolutions for remaining areas.
 3. Slip Resistant Tile for Floors:
 - a. Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance:
 - 1) Not less than 0.6, except 0.8 on ramps as stated above, for wet and dry conditions for other areas.

- B. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, with cushion edges. Porcelain tile produced by the dust pressed method shall be made of approximately 50% feldspar; the remaining 50% shall be made up of various high-quality light firing ball clays yielding a tile with a water absorption rate of 0.5% or less and a breaking strength of between 390 to 400 pounds.

2.2 CEMENTITIOUS BACKER UNITS

- A. Use in elevator cab.
- B. ASTM C1325.
- C. Use Cementitious backer units in maximum available lengths.

2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A108.1.
- C. Joint material, including reinforcing tape, and tape embedding material, shall be as specifically recommended by the backer unit manufacturer.

2.4 FASTENERS

- A. Screws for Cementitious Backer Units.
 - 1. Standard screws for gypsum board are not acceptable.
 - 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
 - 3. ASTM C954 for steel 1 mm (0.033 inch) thick.
 - 4. ASTM C1002 for steel framing less than 0.0329 inch thick.
- B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

2.5 GLASS MAT WATER RESISTANT GYPSUM BACKER BOARD

Confirm to ASTM C1178/C1178M, Optional System for Cementitious Backer Units.

2.6 SETTING MATERIALS OR BOND COATS

- A. Conform to TCA Handbook for Ceramic Tile Installation.
- B. Portland Cement Mortar: ANSI A108.1.
- C. Latex-Portland Cement Mortar: ANSI A108.1.
 - 1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A108.1.
 - 2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

- D. Dry-Set Portland Cement Mortar: ANSI A108.1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A108.4.
- E. Organic Adhesives: ANSI A108.1, Type 1.
- F. Chemical-Resistant Bond Coat:
 - 1. Epoxy Resin Type: ANSI A108.1.
 - 2. Furan Resin Type: ANSI A108.1.

2.7 GROUTING MATERIALS

- A. Coloring Pigments:
 - 1. Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
 - 2. Add coloring pigments to grout by the manufacturer.
 - 3. Job colored grout is not acceptable.
 - 4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.
- B. Commercial Portland Cement Grout: ANSI A108.1 color as specified.
- C. Latex-Portland Cement Grout: ANSI A108.1 color as specified.
 - 1. Unsanded grout mixture for joints 3.2 mm (1/8 inch) and narrower.
 - 2. Sanded grout mixture for joints 3.2 mm (1/8 inch) and wider.

2.8 PATCHING AND LEVELING COMPOUND

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Shall have minimum following physical properties:
 - 1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
 - 2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
 - 3. Tensile strength - 600 psi per ANSI 118.7.
 - 4. Density - 1.9.
- C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 100 mm (four inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.
- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
- E. Ready for use in 48 hours after application.

2.9 WATER

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

2.10 CLEANING COMPOUNDS

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

2.11 FLOOR MORTAR BED REINFORCING

ASTM A185 welded wire fabric without backing, MW3 x MW3 (2 x 2-W0.5 x W0.5).

2.12 POLYETHYLENE SHEET

- A. Polyethylene sheet conforming to ASTM D4397.
- B. Nominal thickness: 0.15 mm (six mils).
- C. Use sheet width to minimize joints.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.
- C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).
- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).
- E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after fourth day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
 - 1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
 - 2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.
- B. Variation in Plane of Wall Surfaces:
 - 1. Not more than 1 in 400 (1/4 inch in eight feet) from required plane where Portland cement mortar setting bed is used.

2. Not more than 1 in 800 (1/8 inch in eight feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION

A. Patching and Leveling:

1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
 - a. Thickness of compound as required to bring finish tile system to elevation shown.
 - b. Float finish.
 - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

3.4 CEMENTITIOUS BACKER UNITS

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A108.1 except as specified otherwise.
- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a V joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 200 mm (eight inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.
- E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.
- F. Do not install joint treatment for seven days after installation of cementitious backer unit.
- G. Joint Treatment:
 1. Fill horizontal and vertical joints and corners with latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
 2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

3.5 GLASS MAT WATER-RESISTANT GYPSUM BACKER BOARD

- A. Install in accordance with manufacturer's instructions. TCA Systems W245-01.
- B. Treat joints with tape and latex-Portland cement mortar or adhesive.

3.6 CERAMIC TILE - GENERAL

- A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.
- B. Comply with TCA Installation Guidelines:
- C. Installing Mortar Beds for Floors:
 - 1. Install mortar bed to not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
 - 2. Install floor mortar bed reinforcing centered in mortar fill.
 - 3. Screed finish to level plane or slope to drains where shown, float finish.
 - 4. For thin set systems cure mortar bed not less than seven days. Do not use curing compounds or coatings.
 - 5. For tile set with Portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.
- D. Setting Beds or Bond Coats:
 - 1. Where recessed or depressed floor slabs are filled with Portland cement mortar bed, set ceramic mosaic floor tile in either Portland cement paste over plastic mortar bed or latex-Portland cement mortar over cured mortar bed except as specified otherwise, ANSI A108-1C, TCA System F121-02 or F111-02.
 - 2. Use quarry tile in chemical-resistant bond coat, except in floor of walk-in refrigerator rooms use: TCA system R 612-02.
 - a. Portland cement paste over plastic mortar bed. ANSI A108.1A.
 - b. Dry-set Portland cement mortar over cured mortar bed. ANSI A108.1B.
 - 4. Set floor tile in elastomeric bond coat over elastomeric membrane ANSI 108. 13, TCA System F122 in elevator cab.
- E. Workmanship:
 - 1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field.
 - 2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise.
 - 3. Form intersections and returns accurately.
 - 4. Cut and drill tile neatly without marring surface.
 - 5. Cut edges of tile abutting penetrations, finish, or built-in items:

- a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
 - b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work shall be free from hollow sounding areas and loose, cracked or defective tile.
7. Remove and reset tiles that are out of plane or misaligned.
8. Floors:
 - a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
 - b. Align finish surface of new tile work flush with other and existing adjoining floor finish where shown.
 - c. In areas where floor drains occur, slope to drains where shown.
 - d. Shove and vibrate tiles over 200 mm (8 inches) square to achieve full support of bond coat.
9. Joints:
 - a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
 - b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
 - c. Make joints in quarry tile work not less than 6 mm (1/4 inch) nor more than 9 mm (3/8 inch) wide. Finish joints flush with surface of tile.
 - d. Make joints in Paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.

3.7 PORCELAIN TILE INSTALLED WITH LATEX PORTLAND CEMENT BONDONG MORTAR

Due to the denseness of porcelain tile use latex Portland cement bonding mortar that meets the requirements of ANSI A108.1. Bonding mortars shall be mixed in accordance with manufacturer's instructions. Improper liquid ratios and dwell time before placement of bonding mortar and tile shall affect bond.

3.8 GROUTING

A. Grout Type and Location:

1. Grout for glazed paver tile latex-Portland cement grout or commercial Portland cement grout.

B. Workmanship:

1. Install and cure grout in accordance with the applicable standard.
2. Portland Cement grout: ANSI A108.1.
3. Epoxy Grout: ANSI A108.1.
4. Furan and Commercial Portland Cement Grout: ANSI A108.1 and in accordance with the manufacturer's printed instructions.
5. Dry-set grout: ANSI A108.1.

3.9 MOVEMENT JOINTS

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.
- B. TCA details EJ 171-02.
- C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.
- D. Rake out grout at joints between tile at edge of elevator cab not less than 6 mm (1/4 inch) deep.
- E. Provide expansion joints at edge of elevator cab.

3.10 CLEANING

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used shall not damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with epoxy, furan and commercial Portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

3.11 PROTECTION

- A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.
- B. Where traffic occurs over tile floor, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

3.12 TESTING FINISH FLOOR

- A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.
- B. Test kitchen and storage rooms.

- - - E N D - - -

SECTION 09 54 23
LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section Includes:
 - 1. Suspended metal grid ceiling system including trim.
 - 2. Decorative, linear, formed metal ceiling panels, mechanically mounted on a ceiling suspension system.
 - 3. Accessories:
 - a. Closures, trim, edge molding and all other items required to provide complete installation.
- B. Unit size, texture, finish, and color as specified.
- C. Location and extent of acoustical treatment as shown.

1.2 RELATED WORK

- A. Finish Color: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Interior Lighting: Section 26 51 00, INTERIOR LIGHTING.

1.3 QUALITY CONTROL

- A. Qualifications:
 - 1. Approval required of products or service of proposed manufacturer, suppliers and installers, and shall be based upon submission by Contractor of certification that:
 - a. Manufacturer regularly and presently, manufactures and installs linear metal ceiling systems and related accessories as one of its principal products and has a record of successful in-service performance.
 - b. Accessories required for linear metal ceiling systems shall be manufacturer's standard or other systems compatible with linear metal ceiling system manufacturer's material. Items shall be of materials and construction which shall provide desired functional service.
 - 2. Installer: Approved in writing by manufacturer.
- B. Coordination of Work: Coordinate layout and installation of linear metal ceiling units and suspension system components with other work supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any):
 - 1. HVAC Air Outlets and Inlets: Shall be planned to occur within center of panel systems or provide for equal distance on each side parallel to length of panels

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Product Data:
 - 1. Manufacturer's standard details and fabrication methods.
 - 2. Data on finishing, hardware, components, and accessories.
 - 3. Recommendations for maintenance and cleaning of finish surfaces.
- C. Shop Drawings:
 - 1. Submit complete composite fabrication, and installation shop drawings including associated components.
 - 2. Identify panel sections, baffles, edge trim, lighting trim, air diffuser sections and trim, sprinkler head locations and trim, other component parts, not included in manufacturer's product data, by name and material and showing design, construction, installation, and anchorage.
 - 3. Layout and installation details, including relation to adjacent work such as walls and bulkheads.
 - 4. Composite reflected ceiling plans, at 1:50 (1/4 inch) scale, showing location of all accessories, mechanical and electrical components. _
Indicate following:
 - a. Joint pattern.
 - b. Ceiling suspension members.
 - c. Method of attaching hangers to building structure.
 - d. Ceiling-mounted items including light fixtures, air outlets and inlets, speakers, sprinkler heads, and access panels. Special moldings at walls, column penetrations, and other junctures with adjoining construction.
 - 5. Detail sections of typical composite members, at wall surfaces, mechanical diffusers and grilles, sprinkler heads, and light fixtures.
 - 6. Provisions for expansion and contraction.
 - 7. Anchors and reinforcements.
- D. Samples:
 - 1. Submit pairs of samples of each specified color and finish on 300 mm (12 inch) long sections of extrusions or formed shapes for following:
 - a. Linear metal panel.
 - b. Each exposed molding and trim sections.
 - c. Suspension system members.
 - d. Filler strips.
 - f. End cap.

2. Where normal color variations are anticipated, include 2 units in set indicating extreme limits of color variations.
3. Integrally Colored Anodized or Prefinished Aluminum:
 - a. Sheet not less than 200 mm by 250 mm (eight inches by ten inches).

E. Certificates:

1. Stating that linear metal ceiling system material has been given specified thickness of anodizing or organic coating finish.
2. Indicating manufacturer's and installer's meet qualifications as specified.
3. Submit list of equivalent size installations which have had satisfactory operation.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Materials: Deliver to site in manufacturer's original unopened containers with brand name and type clearly marked.
- B. Materials: Carefully handle and store in dry, watertight enclosures.
- C. Immediately before installation, linear metal ceiling units shall be stored for not less than 48 hours at same temperature and relative humidity as space where they will be installed to assure temperature and moisture conditions in accordance with manufacturer's recommendations.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
2605-11.....High Performance Organic Coatings on
Architectural Extrusions and Panels.
- C. American Society for Testing and Materials (ASTM):
A641/641M-09.....Zinc-coated (Galvanized) Carbon Steel Wire.
A653/A653M-10.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-
Iron Alloy-Coated (Galvannealed) by Hot-Dip
Process.
B209/B209M-07.....Aluminum and Aluminum-Alloy Sheet and Plate.
C635-07.....Manufacture, Performance, and Testing of Metal
Suspension Systems for Acoustical Tile and Lay-
In Panel Ceilings.
C636-08.....Installation of Metal Ceiling Suspension Systems
for Acoustical Tile and Lay-In Panels.
E90-09.....Laboratory Measurement of Airborne Sound
Transmission Loss of Building Partitions.

E580-10.....Application of Ceiling Suspension Systems for
Acoustical Tile and Lay-in Panels in Areas
Requiring Seismic Restraint.

D. National Association of Architectural Metal Manufacturers (NAAMM):
Metal Finishes Manual (2006)

1.7 ENVIRONMENTAL REQUIREMENTS

Uniform temperature of not less than 16 °C, (60 °F) nor more than 27 °C, (80 °F) and a relative humidity of not more than 70 percent shall be maintained for a period of 48 hours before, during, and for 48 hours after installation of linear metal ceiling units. After above period, room temperature shall not fall below 13 °C (55 °F).

1.8 SCHEDULING

Interior finish work such as plastering, gypsum board finishing, painting, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.9 WARRANTY

Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to two (2) years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Linear Metal Ceiling System, General:

1. Sheet Metal Characteristics: Form metal panels from sheet metal free from surface blemishes where exposed to view in finished unit. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, stains, discolorations, or other imperfections.
2. Fabrication: Die-form linear metal panels into units standard with manufacturer and finished as specified herein.

B. Accessories: Stabilizer bars, clips, splices, hold down clips as required for suspended grid system.

C. Linear Metal Panels:

1. General: Formed to snap on and be securely retained on carriers without separate fasteners.
2. Aluminum Panels: ASTM B209/B209m, roll-formed sheet, alloy 3005-H26, complying with following requirements:
 - a. Minimum Nominal Thickness: 0.40 mm (0.024 inch).

D. Suspension Systems, General:

1. Standard for Metal Suspension Systems: Provide manufacturer's standard types, structural classifications, and finishes indicated that comply with ASTM C635 requirements.
2. Anchors: Type as recommended by manufacturer. Size for five times design load indicated in ASTM C635, Table 1, Direct Hung, unless otherwise indicated.

E. Wire for Carriers, Hangers, and Ties: ASTM A641/A641m, Class 1, zinc coating, soft temper.

1. Gage: Minimum 12 gage. Shall support a minimum of 1330 N, (300 pounds ultimate vertical load without failure of supporting material or attachment.

F. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.

G. Flat Hangers: Mild steel, zinc coated, or protected with rust-inhibitive paint.

H. Angle Hangers: Angles with legs not less than 22 mm (7/8 inch) wide, formed with 0.82 mm (0.0365 inch) galvanized steel sheet complying with ASTM A653/A653m, Coating Designation G90, with bolted connections and 7.6 mm (5/16 inch) diameter bolts.

J. Carriers: Comply with ASTM A653/A653m, cold-rolled, electro-galvanized, 0.375 mm (0.0209 inch) (25 gage) minimum nominal thickness steel.

2.2 FINISHES

A. Comply with NAAMM "Metal Finishes Manual".

B. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent ceiling units not acceptable. Noticeable variations in same piece not acceptable.

D. Aluminum Finishes:

1. Color and Gloss: Refer to Section 09 06 00, SCHEDULE FOR FINISHES.

PART 3 - EXECUTION

3.1 INSPECTION

A. Ceiling Areas: Conform with details, dimensions and tolerances shown on approved linear metal ceiling system composite reflected ceiling plan shop drawings.

B. Conditions which may adversely affect linear metal ceiling system installation shall be brought to Contractors attention, for repair, prior to commencement of linear metal ceiling system installation. Do

not start ceiling installation until affected area has been repaired to Installer's satisfaction.

- C. Where linear metal ceiling system is installed adjacent to masonry, washdown of adjacent masonry shall be completed prior to erection of ceiling system to prevent damage to material finish by cleaning materials.

3.2 PREPARATION

Measure each ceiling area and establish layout of linear metal panel units to balance border widths at opposite edges of each ceiling. Avoid using units less than half wide at borders.

3.3 INSTALLATION

- A. Standard for Installation of Ceiling Suspension Systems: Comply with ASTM C636 and as applicable to linear metal panel ceiling suspension system.
- B. Suspend ceiling hangers from building structural members and as follows:
 - 1. Install hangers plumb, free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers where required to avoid obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 3. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for structure to which hangers are attached as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail because of age, corrosion, and elevated temperatures.
 - 4. Space hangers not more than 1200 mm (48 inches) on center along each member supported directly from hangers, unless otherwise shown.
- C. Install edge moldings at edge of each linear metal ceiling area and at locations where edge of units would otherwise be exposed after completion of Work. Level moldings with ceiling suspension system to level tolerance of 3 mm (1/8 inch) in 3600 mm (12 feet).
 - 1. Masonry and Concrete: Fasten with machine screws into lead-shield-type anchors drilled into construction.

2. Hollow Masonry or Stud Construction: Fasten with toggle bolts or similar self-expanding screw anchors.

D. Ceiling Access Doors:

1. Ceiling access doors shall be located directly under items which require access.

E. Scribe and cut metal panel units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.

F. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise-shown.

G. Install panels with butt joints using internal concealed panel splices and in joint configurations shown in reflected ceiling plan.

H. Install acoustical insulation blankets at right angle to panels so that they do not hang unsupported.

3.4 CLEANING

Following installation, dirty or discolored surfaces of linear metal ceiling units shall be cleaned, in accordance with manufacturer's written recommendations, and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

3.5 PROTECTION

Protect linear metal ceiling systems from damage until final inspection and acceptance.

- - - END - - -

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: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Asphalt and concrete pavement marking: Section 32 17 23, PAVEMENT MARKINGS.

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 Section 09 06 00, SCHEDULE FOR FINISHES.
 - 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.
 4. Intumescent clear coating or fire retardant paint.
 5. Plastic floor 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 MOCK-UP PANEL

- A. Before starting application of water paint mixtures, cementitious paint, apply paint as specified to an area, not to exceed 9 m² (100 ft²), selected by Contracting Officer Representative.
- B. Finish and texture approved by Contracting Officer Representative will be used as a standard of quality for remainder of work.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. American National Standards Institute (ANSI):
A13.1-07.....Scheme for the Identification of Piping Systems
- D. American Society for Testing and Materials (ASTM):
D260-86.....Boiled Linseed Oil
- E. Commercial Item Description (CID):
A-A-1555.....Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)
A-A-3120.....Paint, For Swimming Pools (RF) (cancelled)
- F. Federal Specifications (Fed Spec):
TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- G. Master Painters Institute (MPI):
No. 1-12.....Aluminum Paint (AP)
No. 4-12.....Interior/ Exterior Latex Block Filler
No. 5-12.....Exterior Alkyd Wood Primer
No. 7-12.....Exterior Oil Wood Primer
No. 8-12.....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)
No. 9-12.....Exterior Alkyd Enamel MPI Gloss Level 6 (EO)

- No. 10-12.....Exterior Latex, Flat (AE)
- No. 11-12.....Exterior Latex, Semi-Gloss (AE)
- No. 18-12.....Organic Zinc Rich Primer
- No. 22-12.....Aluminum Paint, High Heat (up to 590° - 1100F)
(HR)
- No. 26-12.....Cementitious Galvanized Metal Primer
- No. 27-12.....Exterior / Interior Alkyd Floor Enamel, Gloss (FE)
- No. 31-12.....Polyurethane, Moisture Cured, Clear Gloss (PV)
- No. 36-12.....Knot Sealer
- No. 43-12.....Interior Satin Latex, MPI Gloss Level 4
- No. 44-12.....Interior Low Sheen Latex, MPI Gloss Level 2
- No. 45-12.....Interior Primer Sealer
- No. 46-12.....Interior Enamel Undercoat
- No. 47-12.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
- No. 48-12.....Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
- No. 49-12.....Interior Alkyd, Flat, MPI Gloss Level 1 (AK)
- No. 50-12.....Interior Latex Primer Sealer
- No. 51-12.....Interior Alkyd, Eggshell, MPI Gloss Level 3
- No. 52-12.....Interior Latex, MPI Gloss Level 3 (LE)
- No. 53-12.....Interior Latex, Flat, MPI Gloss Level 1 (LE)
- No. 54-12.....Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
- No. 59-12.....Interior/Exterior Alkyd Porch & Floor Enamel, Low
Gloss (FE)
- No. 60-12.....Interior/Exterior Latex Porch & Floor Paint, Low
Gloss
- No. 66-12.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC
Approved) (FC)
- No. 67-12.....Interior Latex Fire Retardant, Top-Coat (ULC
Approved) (FR)
- No. 68-12.....Interior/ Exterior Latex Porch & Floor Paint,
Gloss
- No. 71-12.....Polyurethane, Moisture Cured, Clear, Flat (PV)
- No. 74-12.....Interior Alkyd Varnish, Semi-Gloss
- No. 77-12.....Epoxy Cold Cured, Gloss (EC)
- No. 79-12.....Marine Alkyd Metal Primer
- No. 90-12.....Interior Wood Stain, Semi-Transparent (WS)
- No. 91-12.....Wood Filler Paste
- No. 94-12.....Exterior Alkyd, Semi-Gloss (EO)
- No. 95-12.....Fast Drying Metal Primer
- No. 98-12.....High Build Epoxy Coating

- No. 101-12.....Epoxy Anti-Corrosive Metal Primer
- No. 108-12.....High Build Epoxy Coating, Low Gloss (EC)
- No. 114-12.....Interior Latex, Gloss (LE) and (LG)
- No. 119-12.....Exterior Latex, High Gloss (acrylic) (AE)
- No. 135-12.....Non-Cementitious Galvanized Primer
- No. 138-12.....Interior High Performance Latex, MPI Gloss Level 2
(LF)
- No. 139-12.....Interior High Performance Latex, MPI Gloss Level 3
(LL)
- No. 140-12.....Interior High Performance Latex, MPI Gloss Level 4
- No. 141-12.....Interior High Performance Latex (SG) MPI Gloss
Level 5

H. Steel Structures Painting Council (SSPC):

- SSPC SP 1-04 (R2004)....Solvent Cleaning
- SSPC SP 2-04 (R2004)....Hand Tool Cleaning
- SSPC SP 3-04 (R2004)....Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cementitious Paint (CEP): TT-P-1411A [Paint, Copolymer-Resin, Cementitious (CEP)], Type 1 for exterior use, Type II for interior use.
- B. Wood Sealer: MPI 31 (gloss) or MPI 71 (flat) thinned with thinner recommended by manufacturer at rate of about one part of thinner to four parts of varnish.
- C. Plastic Tape:
 - 1. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.
 - 2. Pressure sensitive adhesive back.
 - 3. Widths as shown.
- D. Identity markers options:
 - 1. Pressure sensitive vinyl markers.
 - 2. Snap-on coil plastic markers.
- E. Aluminum Paint (AP): MPI 1.
- F. Interior/Exterior Latex Block Filler: MPI 4.
- G. Exterior Alkyd Wood Primer: MPI 5.
- H. Exterior Oil Wood Primer: MPI 7.
- I. Exterior Alkyd, Flat (EO): MPI 8.
- J. Exterior Alkyd Enamel (EO): MPI 9.
- K. Exterior Latex, Flat (AE): MPI 10.
- L. Exterior Latex, Semi-Gloss (AE): MPI 11.

- M. Organic Zinc rich Coating (HR): MPI 22.
- N. High Heat Resistant Coating (HR): MPI 22.
- O. Cementitious Galvanized Metal Primer: MPI 26.
- P. Exterior/ interior Alkyd Floor Enamel, Gloss (FE): MPI 27.
- Q. Knot Sealer: MPI 36.
- R. Interior Satin Latex: MPI 43.
- S. Interior Low Sheen Latex: MPI 44.
- T. Interior Primer Sealer: MPI 45.
- U. Interior Enamel Undercoat: MPI 47.
- V. Interior Alkyd, Semi-Gloss (AK): MPI 47.
- W. Interior Alkyd, Gloss (AK): MPI 49.
- x. Interior Latex Primer Sealer: MPI 50.
- Y. Interior Alkyd, Eggshell: MPI 51
- Z. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.
- AA. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.
- BB. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.
- DD. Interior / Exterior Alkyd Porch & Floor Enamel, Low Gloss (FE): MPI 59.
- EE. Interior/ Exterior Latex Porch & Floor Paint, Low Gloss: MPI 60.
- FF. Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved) (FC): MPI 66.
- GG. Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR): MPI 67.
- HH. Interior/ Exterior Latex Porch & Floor Paint, gloss: MPI 68.
- II. Epoxy Cold Cured, Gloss (EC): MPI 77.
- JJ. Marine Alkyd Metal primer: MPI 79.
- KK. Interior Wood Stain, Semi-Transparent (WS): MPI 90.
- LL. Wood Filler Paste: MPI 91.
- MM. Exterior Alkyd, Semi-Gloss (EO): MPI 94.
- NN. Fast Drying Metal Primer: MPI 95.
- OO. High Build Epoxy Coating: MPI 98.
- PP. Epoxy Anti-Corrosive Metal Primer: MPI 101.
- QQ. High Build Epoxy Marine Coating (EC): MPI 108.
- RR. Interior latex, Gloss (LE) and (LG): MPI 114.
- SS. Exterior Latex, High Gloss (acrylic) (AE): MPI 119.
- TT. Waterborne Galvanized Primer: MPI 134.
- UU. Non-Cementitious Galvanized Primer: MPI 135.
- VV. Interior High Performance Latex, MPI Gloss Level 2(LF): MPI 138.
- WW. Interior High Performance Latex, MPI Gloss Level 3 (LL): MPI 139.
- XX. Interior High Performance Latex, MPI Gloss Level 4: MPI 140.
- YY. Interior High Performance Latex (SG), MPI Gloss Level 5: MPI 141.

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.
 - c. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
 - 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.
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. 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.

D. 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, Section 04 05 16, MASONRY GROUTING. Do not fill weep holes. Finish 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.

E. 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 application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Contracting Officer Representative.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.

Contracting Officer Representative

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.
- G. 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.
- F. Metals except boilers, incinerator stacks, and engine exhaust pipes:
 1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer).
 2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer).
 3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
 4. Terne Metal: MPI 79 (Marine Alkyd Metal Primer).
 5. 6. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel (EO)).
 6. Asphalt coated metal: MPI 1 (Aluminum Paint (AP)).
 7. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating (HR)).
- G. Gypsum Board and Glass Mat Sheathing:
 1. Surfaces scheduled to have MPI 10 (Exterior Latex, Flat (AE)), MPI 11 (Exterior Latex, Semi-Gloss (AE)) finish: Use MPI 10 (Exterior Latex, Flat (AE)), MPI 11 (Exterior Latex, Semi-Gloss (AE)) respectively.
 - 2.
- I. Concrete Masonry Units except glazed or integrally colored and decorative units:
 1. MPI 4 (Block Filler) on interior surfaces.
 2. Prime exterior surface as specified for exterior finishes.
- J. Concrete Floors: MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss).

3.6 EXTERIOR FINISHES

- A. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Wood:
 - 1. Do not apply finish coats on surfaces concealed after installation.
 - 2. Two coats of MPI 10 Exterior Latex, Flat (AE)) on exposed surfaces.
- C. Steel and Ferrous Metal:
 - 1. Two coats of MPI 8 (Exterior Alkyd, Flat (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).
 - 2. One coat of MPI 22 (High Heat Resistant Coating (HR)) on surfaces over 94 degrees K (200 degrees F) and on surfaces of boiler .
- D. Machinery without factory finish except for primer: One coat MPI 8 (Exterior Alkyd, Flat (EO)) .
- E. Concrete Masonry Units, Concrete:
 - 1. General:
 - a. Where specified in Section 09 06 00, SCHEDULE FOR FINISHES or shown.
 - b. Mix as specified in manufacturer's printed directions.
 - c. Do not mix more paint at one time than can be used within four hours after mixing. Discard paint that has started to set.
 - d. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.
 - e. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.
 - 2. Use two coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious (CEP)), unless specified otherwise.

3.7 INTERIOR FINISHES

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Metal Work:
 - 1. Apply to exposed surfaces.
 - 2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
 - 3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
 - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.
 - b. Two coats of MPI 48 (Interior Alkyd Gloss (AK)).

- c. One coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) on exposed interior surfaces of alkyd-amine enamel prime finished windows.
 - d. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).
 - e. Asphalt Coated Metal: One coat MPI 1 (Aluminum Paint (AP)).
 - f. Ferrous Metal over 94 degrees K (200 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One coat MPI 22 (High Heat Resistant Coating (HR)).
- C. Gypsum Board and Glass Mat Sheathing:
- 1. One coat of MPI 45 (Interior Primer Sealer) plus one coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3 (LL)).
 - 2. Two coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2 (LF)).
 - 3. One coat of MPI 45 (Interior Primer Sealer) plus one coat of MPI 48 (Interior Alkyd Gloss (AK)).
- D. Masonry and Concrete Walls:
- 1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
- I. Miscellaneous:
- 1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
 - 2. MPI 1 (Aluminum Paint): Two coats of aluminum paint.
 - 3. Gold Paint (GP): Two coats of gold paint.

3.8 REFINISHING EXISTING PAINTED SURFACES

- A. Clean, patch and repair existing surfaces as specified under surface preparation.
- B. Remove and reinstall items as specified under surface preparation.
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one coat of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss).
- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.

- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.9 PAINT COLOR

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
- C. Coat Colors:
 - 1. Color of priming coat: Lighter than body coat.
 - 2. Color of body coat: Lighter than finish coat.
 - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
 - 1. Paint to match color of casework where casework has a paint finish.
 - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.10 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 Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
 - a. WhiteExterior 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. Exterior Locations:
 - a. Apply two coats of MPI 8 (Exterior Alkyd, Flat (EO)) to the following ferrous metal items:
Vent and exhaust pipes with temperatures under 94 degrees C (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
 - b. Apply two coats of MPI 10 (Exterior Latex, Flat (AE)) to the following metal items:
Galvanized and zinc-copper alloy metal.
 - c. Apply one coat of MPI 22 (High Heat Resistant Coating (HR)), 650 degrees C (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.
 2. Interior Locations:
 - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:

- 1) Metal under 94 degrees C (200 degrees F) of items such as bare piping, fittings, hangers and supports.
- 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
- 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
- b. Apply one coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1 (LE)) on finish of insulation on boiler breeching and uptakes inside boiler house, drums, drumheads, oil heaters, feed water heaters, tanks and piping.
- d. Apply two coats of MPI 22 (High Heat Resistant Coating (HR)) to ferrous metal surface over 94 degrees K (200 degrees F) of following items:
 - 1) Garbage and trash incinerator.
 - 2) Medical waste incinerator.
 - 3) Exterior of boilers and ferrous metal in connection with boiler settings including supporting members, doors and door frames and fuel oil burning equipment.
 - 4) Steam line flanges, bare pipe, fittings, valves, hangers and supports over 94 degrees K (200 degrees F).
 - 5) Engine generator exhaust piping and muffler.
- e. Paint electrical conduits containing cables rated 600 volts or more using two coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.
3. Other exposed locations:
 - a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two coats of MPI 1 (Aluminum Paint (AP)).

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 work including colors and gloss of finish selected is specified in Finish Schedule, Section 09 06 00, SCHEDULE FOR FINISHES.
 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
 3. Painting of ferrous metal and galvanized metal.
 4. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Prefinished items:
 - a. 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. Concrete floors of parking deck
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 (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
 3. Locate Legends clearly visible from operating position.
 4. Use arrow to indicate direction of flow.
 5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
 - a. High Pressure - 414 kPa (60 psig) and above.
 - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
 - c. Low Pressure - 103 kPa (14 psig) and below.
 - d. Add Fuel oil grade numbers.
 6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND BBREVIATIONS
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
Drain Line		Green	White	Drain
Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret

Vacuum Condensate Return	Yellow	Black	Vac Cond Ret
Fuel Oil - Grade	Brown	White	Fuel Oil-Grade __*
(Diesel Fuel included under Fuel Oil)			
Vent Line	Yellow	Black	Vent
Cold Water (Domestic) White	Green	White	C.W. Dom
Sanitary Waste	Green	White	San Waste
Sanitary Vent	Green	White	San Vent
Storm Drainage	Green	White	St Drain
Pump Drainage	Green	White	Pump Disch
Atmospheric Vent	Green	White	ATV
Fuel Gas	Yellow	Black	Gas
Fire Protection Water			
Sprinkler	Red	White	Auto Spr
Standpipe	Red	White	Stand
Sprinkler	Red	White	Drain

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 or 25000.

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

a. Conduits containing high voltage feeders over 600 volts: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, Section 28 05 33, RACEWAYS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY.

B. Fire Partitions (as denoted in life safety as having a 1 hr rating:

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: "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.

- - - E N D - - -

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

Acrylic Emulsion AE (MPI 10 - flat/MPI 11 - semigloss/MPI 119 - gloss)
Alkyd Flat Ak (MPI 49)
Alkyd Gloss Enamel G (MPI 48)
Alkyd Semigloss Enamel SG (MPI 47)
Aluminum Paint AP (MPI 1)
Cementitious Paint CEP (TT-P-1411)
Exterior Latex EL??(MPI 10 / 11 / 119)??
Exterior Oil EO (MPI 9 - gloss/MPI 8 - flat/MPI 94 - semigloss)
Epoxy Coating EC (MPI 77 - walls, floors/MPI 108 - CMU, concrete)
Fire Retardant Paint FR (MPI 67)
Fire Retardant Coating (Clear) FC (MPI 66, intumescent type)
Floor Enamel FE (MPI 27 - gloss/MPI 59 - eggshell)
Heat Resistant Paint HR (MPI 22)
Latex Emulsion LE (MPI 53, flat/MPI 52, eggshell/MPI 54, semigloss/MPI 114, gloss Level 6)
Latex Flat LF (MPI 138)
Latex Gloss LG (MPI 114)

Salisbury VAMC
Construct New Parking Garage
Salisbury, NC 28144

Project No. 659-342

Latex Semigloss SG (MPI 141)

Latex Low Luster LL (MPI 139)

Plastic Floor Coating PL

Polyurethane Varnish PV (MPI 31 - gloss/MPI 71 - flat)

Rubber Paint RF (CID-A-A-3120 - Paint for Swimming Pools (RF)).

Water Paint, Cement WPC (CID-A-A-1555 - Water Paint, Powder).

- - - E N D - - -

SECTION 10 14 10

SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies interior signage for room numbers, directional signs, code required signs, telephone identification signs and temporary interior signs.
- B. This section also specifies exterior medical center identification signs, building identification signs, parking and traffic signs.
- C. Installation of Government furnished dedication plaque and VA seal.

1.2 RELATED WORK

- A. Electrical: Related Electrical Specification Sections.
- B. Lighted EXIT signs for egress purposes are specified under Division 26, ELECTRICAL.
- C. Section 10 13 00, DIRECTORIES and Section 10 14 00, SIGNAGE.
- D. Color Finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 MANUFACTURER'S QUALIFICATIONS

- A. Sign manufacturer shall provide evidence that they regularly and presently manufactures signs similar to those specified in this section as one of their principal products.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: Sign panels and frames, with letters and symbols, each type. Submit 2 sets. One set of samples will be retained by Owner, other returned to Contractor.
 - 1. Sign Panel, 200 mm x 250 mm (8 inches x 10 inches), with letters.
 - 2. Color samples of each color, 150 mm x 150 mm (6 inches x 6 inches. Show anticipated range of color and texture.
 - 3. Sample of typeface, arrow and symbols in a typical full size layout.
- C. Manufacturer's Literature:
 - 1. Showing the methods and procedures proposed for the concealed anchorage of the signage system to each surface type.
 - 2. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions.
- D. Samples: Sign location plan, showing location, type and total number of signs required.
- E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.
- F. Full size layout patterns for dimensional letters.

1.5 DELIVERY AND STORAGE

- A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.
- B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.
- C. Deliver signs only when the site and mounting services are ready for installation work to proceed.
- D. Store products in dry condition inside enclosed facilities.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate
 - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and tubes.
- C. Federal Specifications (Fed Spec):
 - MIL-PRF-8184F.....Plastic Sheet, Acrylic, Modified.
 - MIL-P-46144C.....Plastic Sheet, Polycarbonate

1.7 MINIMUM SIGN REQUIREMENTS

- A. Permanent Rooms and Spaces:
 - 1. Tactile and Braille Characters, raised minimum 0.793 mm (1/32 in). Characters shall be accompanied by Grade 2 Braille.
 - 2. Type Styles: Characters shall be uppercase, Helvetica Medium, Helvetica Medium Condensed and Helvetica Regular.
 - 3. Character Height: Minimum 16 mm (5/8 in) high, Maximum 50 mm (2 in).
 - 4. Symbols (Pictograms): Equivalent written description shall be placed directly below symbol, outside of symbol's background field. Border dimensions of symbol background shall be minimum 150 mm (6 in) high.
 - 5. Finish and Contrast: Characters and background shall be eggshell, matte or other non-glare finish with adequate contrast with background.
 - 6. Mounting Location and Height: As shown. Mounted on wall adjacent to the latch side of the door and to avoid door swing and protruding objects.
- B. Overhead Signs:
 - 1. Type Styles: As shown. Characters shall have a width-to-height ratio between 3:5 and 1:1. Characters shall have a stroke width-to-height ratio of between 1:5 and 1:10.
 - 2. Character Height: minimum 75 mm (3 in) high for overhead signs. As shown, for directional signs.
 - 3. Finish and Contrast: Same as for signs of permanent rooms and spaces.
 - 4. Mounting Location and Height: As shown.

1.8 COLORS AND FINISHES:

- A. Section 09 06 00, SCHEDULE FOR FINISHES.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs complete with lettering, framing and related components for a complete installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. Engineer to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

2.2 PRODUCTS

- A. Aluminum:
 - 1. Sheet and Plate: ASTM B209.
 - 2. Extrusions and Tubing: ASTM B221.
- B. Cast Acrylic Sheet: MIL-PRF-8184F; Type II, class 1, Water white non-glare optically clear. Matt finish water white clear acrylic shall not be acceptable.
- C. Polycarbonate: MIL-P-46144C; Type I, class 1.
- D. Vinyl: 0.1 mm thick machine cut, having a pressure sensitive adhesive and integral colors.
- E. Electrical Signs:
 - 1. General: Furnish and install all lighting, electrical components, fixtures and lamps ready for use in accordance with the sign type drawings, details and specifications.
 - 2. Refer to Electrical Specifications Section, Division 26, ELECTRICAL, to verify line voltages for sign locations that require electrical signs.
 - 3. Quality Control: Installed electrical components and sign installations are to bear the label and certification of Underwriter's Laboratories, Inc., and are to comply with National Electrical Code as well as applicable federal, state and local codes for installation techniques, fabrication methods and general product safety.
 - 4. Ballast and Lighting Fixtures: See Electrical Specifications.
- F. Concrete Post Footings: See Section 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE, Cast-in-place Concrete.
- G. Steel: See Section 05 12 00, STRUCTURAL STEEL FRAMING.

2.3 SIGN STANDARDS

A. Typography:

1. Type Style: Helvetica Medium and Helvetica Medium Condensed. Initial caps or all caps as indicated in Sign Message Schedule.
2. Arrow: See graphic standards in drawings.
3. Letter spacing: See graphic standards on drawings.
4. Letter spacing: See graphic standards on drawings.
5. All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings are for layout purposes only; final text for signs is listed in Sign Message Schedule.

B. Project Colors and Finishes: See Section 09 06 00, SCHEDULE FOR FINISHES.

2.4 SIGN TYPES

A. General:

1. The interior sign system is comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.
 - a. IN indicates a component construction based sign.
 1. The exterior sign system shall be comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.
 2. EI designation indicates exterior internally illuminated sign.
 3. EN designation indicates exterior non-illuminated sign.

B. Interchangeable Component System:

1. Sign Type Families: 03, 04, 05, 06, 07, 08, 09 10, 11 12, 13, 14, 15, 16 and 17.
2. Interior sign system capable of being arranged in a variety of configurations with a minimum of attachments, devices and connectors.
 - a. Interchangeable nature of the system shall allow for changes of graphic components of the installed sign, without changing sign in its entirety.
 - b. Component Sign System is comprised of the following primary components:
 - 1) Rail Back utilizing horizontal rails, spaced to allow for uniform, modular sizing of sign types.
 - 2) Rail Insert mounted to back of Copy Panels to allow for attachment to Rail Back.
 - 3) Copy Panels, made of a variety of materials to allow for different graphic needs.
 - 4) End Caps which interlock to Rail Back to enclose and secure changeable Copy Panels.
 - 5) Joiners and Accent Joiners connect separate Rail Backs together.
 - 6) Top Accent Bars which provide decorative trim cap that encloses the top of sign or can connect the sign to a Type 03 Room Number Sign.

- c. Rail Back, Rail Insert and End Caps in anodized extruded aluminum to allow for tight tolerances and consistent quality of fit and finish.
 - d. Signs in system shall be convertible in the field to allow for enlargement from one size to another in height and width through use of Joiners or Accent Joiners, which connect Rail Back panels together blindly, providing a butt joint between Copy Panels. Accent Joiners shall connect Rail Backs together with a visible 3 mm (1/8") horizontal rib, flush to the adjacent copy insert surfaces.
 - e. Sign configurations shall vary in width from 225 mm (9 inches) to 2050 mm (80 inches), and have height dimensions of 50 mm (2 inches), 75 mm (3 inches), 150 mm (6 inches), 225 mm (9 inches) and 300 mm (12 inches). Height shall be increased beyond 300 mm (12 inches), by repeating height module in full or in part.
3. Rail Back functions as internal structural member of sign using 6063T5 extruded aluminum and anodized black.
- a. Shall accept an extruded aluminum or plastic insert on one sign or on both sides, depending upon sign type.
 - b. Shall be convertible in field to allow for connection to other Rail Back panels, so that additive changes can be made to sign unit.
 - c. Rail shall allow for a variety of mounting devices including wall mounting for screw-on applications, using pressure sensitive tape, freestanding mount, ceiling mount and other mounting devices as needed.
4. Rail Insert functions as a mounting device for Copy Panels on to the Rail Back. The Rail Insert mounts to the back of the Copy Panel with adhesive suitable for use with the particular copy insert material.
- a. Shall allow Copy Panels to slide or snap into the horizontal Rail Back for ease of changeability.
 - b. Shall mount to the back of the Copy Panel with adhesive suitable for use with particular Copy Panel material.
5. Copy Panels shall accept various forms of copy and graphics, and attaches to the Rail Back with the Rail Insert. Copy Panels shall be either ABS plastic with integral color or an acrylic lacquer finish; photo polymer; or, acrylic.
- a. Interchangeable by sliding horizontally from either side of sign, and to other signs in system of equal or greater width or height.
 - b. Cleanable without use of special chemicals or cleaning solutions.
 - c. Copy Insert Materials.
 - 1) ABS Inserts - 2.3 mm (.090 inches) extruded ABS plastic core with .07 mm (.003 inches) acrylic cap bonded during extrusion/texturing process. Pressure bonded to extruded Rail Insert using adhesive. Background color is either integral or painted in acrylic lacquer. ABS inserts finished in a chromium industries #HM335RA texture pattern to prevent glare.
 - 2) Photo polymer Inserts - 3 mm (.125 inches) phenolic photo polymer with raised copy etched to 2.3 mm (.0937 inches), bonded to an ABS plastic or extruded aluminum insert with adhesive. Background color is painted in acrylic enamel.
 - 3) Changeable Paper/ Insert Holder - Extruded insert holder with integral Rail Insert for connection with structural back panel in 6063T5 aluminum with a black anodized finish. Inserts into holder are paper with a clear 0.7 mm (.030 inches) textured cover. Background color is painted in acrylic lacquer.

- 4) Acrylic - 2 mm (.080 inches) non-glare acrylic. Pressure bonded to extruded Rail Insert using adhesive. Background color is painted in acrylic lacquer or acrylic enamel.
- 5) Extruded 6063T5 aluminum with a black anodized finish Insert Holder with integral Rail Insert for connection with Structural Back Panel to hold a 0.7 mm (.030 inches) textured polycarbonate insert and a Sliding Tile which mounts in the Inset Holder and slides horizontally.
- 6) End Caps - Extruded using 6063T5 aluminum with a black anodized. End Caps interlock with Rail Back with clips to form an integral unit, enclosing and securing the changeable Copy Panels, without requiring tools for assembly.
 - a) Shall be interchangeable to either end of sign and to other signs in the system of equal height.
 - b) Mechanical fasteners can be added to the End Caps that will secure it to Rail Back to make sign tamper resistant.
- 7) Joiners - Extruded using 6063T5 aluminum with a black anodized finish. Rail Joiners connect Rail Backs together blindly, providing a butt joint between Copy Inserts.
- 8) Accent Joiners - Extruded using 6063T5 aluminum with a mirror polished finish. Joiner shall connect Rail Backs together with a visible 3 mm (.125 inches) horizontal rib, flush to the adjacent Copy Panel surfaces.
- 9) Top Accent Rail - Extruded using 6063T5 aluminum with a mirror polished finish. Rail shall provide 3 mm (.125 inches) high decorative trim cap, which butts flush to adjacent Copy Panel and encloses top of Rail Back and Copy Panel.
- 10) Typography
 - a) Vinyl First Surface Copy (non-tactile) - Applied Vinyl copy.
 - b) Subsurface Copy Inserts - Textured 1 mm (.030 inches) clear polycarbonate face with subsurface applied Vinyl copy. Face shall be back sprayed with paint and laminated to an extruded aluminum carrier insert.
 - c) Integral Tactile Copy Inserts - phenolic photo polymer etched with 2.3 mm (.0937 inches) raised copy.
 - d) Silk-screened First Surface Copy (non-tactile) - Injection molded or extruded ABS plastic or aluminum insert with first surface applied enamel silk-screened copy.

SPEC. WRITER NOTE: Delete sign types and sign families that are not being used on the project.

C. Sign Type Family 01, 02.01 thru 02.05, 08, 09 and 20:

1. All text and graphics are to be first surface silk-screened.
2. IN-01.12 & IN-01.13: Refer to Sign Type 03 specification for tactile and Braille portion of sign.
3. IN-02.4: All text and graphics are to be first surface vinyl letters.
4. IN-01.1: Preparation of artwork for reproduction of "fire and emergency evacuation maps" is by manufacturer.

D. Sign Type Families 03:

1. Tactile sign is to be made from a material that provides for letters, numbers and Braille to be integral with sign plaque material such as: photosensitive polyamide resin, etched metal, sandblasted phenolic or embossed material. Do not apply letters, numbers and Braille with adhesive.

2. Numbers, letters and Braille to be raised 0.793 mm (.0312 inches) from the background surface. The draft of the letters, numbers and Braille to be tapered, vertical and clean.
 3. Braille dots are to conform with standard dimensions for literary Braille; (a) Dot base diameter: 1.5 mm (.059 inches) (b) Inter-dot spacing: 2.3 mm (.090 inches) (c) Horizontal separation between cells: 6.0 mm (.241 inches) (d) Vertical separation between cells: 10.0 mm (.395 inches)
 4. Entire assembly is painted in specified color. After painting, apply white or other specified color to surface of the numbers and letters. Entire sign is to have a protective clear coat sealant applied.
 5. Complete sign is to have an eggshell finish (11 to 19 degree on a 60 degree glossmeter).
- E. Sign Type Family 04 and 11:
1. All text and graphics are to be first surface applied vinyl letters.
 2. IN-04: When a Type IN-04 is to be mounted under a Type IN03, a connecting Accent Joiner is to be used to create a singular integrated sign.
- F. Sign Type 05:
1. Text if added to Copy Insert module to be first surface applied vinyl letters.
- G. Sign Type Family 06 and 07:
1. All text and graphics are to be first surface applied vinyl letters except for under sliding tile.
 2. Protect text, which is covered by sliding tile, so tile does not wear away letters.
- H. Sign Type Family 10:
1. Pocket depth is to be 0.3 mm (.0150 inches).
- I. Sign Type Family 12 and 13:
1. All text and graphics are to be first surface applied vinyl letters.
 2. IN-12: Provide felt, cork or similar material on bottom of desk mounting bracket to protect counter surfaces.
- J. Sign Type Family 14, 15, and 16:
1. All text and graphics are to be first surface applied vinyl letters.
 2. IN-14.06: When added to top of IN-14.01, IN-14.04, or IN-14.05 a connecting Accent Joiner is to be used to create a singular integrated sign.
 3. Ceiling mounted signs required mounting hardware on the sign that allows for sign disconnection, removal and reinstallation and reconnection.
- K. Sign Type Family 17:
1. All text and graphics are to be first surface applied vinyl letters.
 2. IN-17: Directory constructed using elements of the Component System.
- L. Sign Type Family 18:
1. All text and graphics are to be first surface applied stylus cut vinyl letters.
 2. Provide in specified typeface, color and spacing, with each message or message group on a single quick release backing sheet.
- M. Sign Type Family 19:
1. Dimensional letters are mill or laser cut acrylic in the size and thickness noted in the drawings.
 2. Draft of letters is perpendicular to letters face.
 3. All corners such as where a letter stem and bar intersect are to be square so the letter form is accurately reproduced.
 4. Paint letters with acrylic polyurethane in specified color and finish.

N. Sign Type Family (See Specialty Signs Section) 21:

1. IN-21.01: 57 mm (2.25 inches) polished aluminum tube mounted to weighted 356 mm (14 inches) diameter polished aluminum base. Sign bracket to hold a 6 mm (.25 inches) sign plaque.
2. IN-21.02: 57 mm (2.25 inches) polished aluminum tube vertical support mounted to a weighted polished 57 mm (2.25 inches) aluminum tubular base. Rail Back mechanically connected to vertical supports with Copy Panel attached to front and back.
3. IN-21.03 & 21.04: IN-21.02: 57 mm (2.25 inches) polished aluminum tube vertical support mounted to a weighted polished 57 mm (2.25 inches) aluminum tubular base. Rail Back mechanically connected to vertical supports with hinged locking glass door. Black felt covered changeable letter board or tan vinyl impregnated cork tack surface as background within case.

O. Sign Type Family 22:

1. IN-22.01: Extruded aluminum clip anodized black containing rollers to pinch and release paper. End caps are black plastic.
2. IN-22.02: Patient Information holder constructed of 18 gauge formed sheet metal painted in specified color. Polished aluminum connecting rods and buttons. Button covers for mounting screws are to permanently attach and securely conceal screws.

P. Temporary Interior Signs:

1. Fabricated from 50 kg (110 pound) matte finished white paper cut to 100 mm (4 inch) wide by 300 mm (12 inch) long. Punched 3 mm (.125 inch) hole with edge of hole spaced 13 mm (.5 inch) in from edge and centered on 100 mm (4 inch) side. Reinforce hole on both sides with suitable material that prevents tie from pulling through hole. Ties are steel wire 0.3 mm (0.120 inch) thick attached to tag with twist leaving 150 mm (6 inch) long free ends.
2. Mark architectural room number on sign, with broad felt marker in clearly legible numbers or letters that identify room, corridor or space as shown on floor plans.
3. Install temporary signs to all rooms that have a room, corridor or space number. Attach to door frame, door knob or door pull.
 - a. Doors that do not require signs are: corridor doors in corridor with same number, folding doors or partitions, toilet doors, bathroom doors within and between rooms, closet doors within rooms, communicating doors in partitions between rooms with corridor entrance doors.
 - b. Replace and missing damaged or illegible signs.

2.5 FABRICATION

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.

- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.
- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth sulrfaces.
- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- K. Movable parts, including hardware, are be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.
- L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- M. No signs are to be manufactured until final sign messages and locations have been approved by the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, coordinate with the Engineer.

- C. Contractor shall be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.
- D. Remove or correct signs or installation work that is unsafe or unacceptable, as required by the Engineer, Architect, or Owner.
- E. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
- F. Locate signs as shown on the Sign Location Plans.
- G. Certain signs may be installed on glass. A blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.
- H. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
- I. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.

---END---

SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

This section covers recessed fire extinguisher cabinets.

1.2 RELATED WORK

- A. Acrylic glazing: Section 08 80 00, GLAZING.
- B. Field Painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

1.4 APPLICATION PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):
D4802-10.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

Recessed type with flat trim, painted red of size and design shown.

2.2 FABRICATION

- A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.
- B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.
 - 1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish 1.
 - 2. Design doors to open 180 degrees.
 - 3. Provide continuous hinge, pull handle, and adjustable roller catch.

2.3 FINISH

- A. Finish interior of cabinet body with baked-on semigloss white enamel.
- B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

PART 3 - EXECUTION

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
- B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.

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SECTION 11 05 12
GENERAL MOTOR REQUIREMENTS FOR EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the furnishing, installation and connection of motors.

1.2 RELATED WORK:

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one Section of Division 26.
- B. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS: Starters, control and protection for motors.
- C. Section 26 24 19, MOTOR-CONTROL CENTERS: Multiple motor control assemblies, which include motor starters.
- D. Other sections specifying motor driven equipment in Divisions 11 and 14.

1.3 SUBMITTALS:

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, materials, horsepower, RPM, enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
- C. Manuals:
 - 1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and application data.
- D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certification to the Contracting Officer Representative:
 - 1. Certification that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.4 APPLICABLE PUBLICATIONS:

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. National Electrical Manufacturers Association (NEMA):

MG 1-09(R2010).....Motors and Generators

MG 2-01(R2007).....Safety Standard and Guide for Selection,
Installation and Use of Electric Motors and
Generators

C. National Fire Protection Association (NFPA):

70-11.....National Electrical Code (NEC)

PART 2 - PRODUCTS

2.1 MOTORS:

A. For alternating current, fractional and integral horsepower motors, NEMA Publications MG 1 and MG 2 shall apply.

B. Voltage ratings shall be as follows:

1. Single phase:

- a. Motors connected to 120-volt systems: 115 volts.
- b. Motors connected to 208-volt systems: 200 volts.
- c. Motors connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.

2. Three phase:

- a. Motors connected to 208-volt systems: 200 volts.
- b. Motors, less than 74.6 kW (100 HP), connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
- c. Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.
- d. Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.
- e. Motors connected to high voltage systems: Shall conform to NEMA Standards for connection to the nominal system voltage shown on the drawings.

C. Number of phases shall be as follows:

- 1. Motors, less than 373 W (1/2 HP): Single phase.
- 2. Motors, 373 W (1/2 HP) and larger: 3 phase.
- 3. Exceptions:
 - a. Hermetically sealed motors.
 - b. Motors for equipment assemblies, less than 746 W (one HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

D. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

- E. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.
- F. Motor Enclosures:
1. Shall be the NEMA types shown on the drawings for the motors.
 2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed.
 3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.
- G. Additional requirements for specific motors, as indicated in other sections, shall also apply.
- H. Energy-Efficient Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 Watts or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%

56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

I. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.

J. Premium efficiency motors shall be used where energy cost/kW x (hours use/year) > 50.

PART 3 - EXECUTION

3.1 INSTALLATION:

Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

3.2 FIELD TESTS

Megger all motors after installation, before start-up. All shall test free from grounds.

- - - E N D - - -

SECTION 14 21 00
ELECTRIC TRACTION ELEVATORS

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section specifies the engineering, furnishing and installation of complete and ready for operation electric traction elevator systems described herein and as indicated on the contract drawings.
- B. Items listed in the singular apply to each and every elevator in this specification except where noted.
- C. Passenger Elevators No. P1, P2, shall be overhead geared traction type; with Variable Voltage Variable Frequency (VVVF) microprocessor based control system with regenerative drive single-speed center opening and side opening car and hoistway doors. Elevators shall have Class "A" loading.

1.2 RELATED WORK

- A. Section 01 33 23 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
- C. SECTION 09 06 00, SCHEDULE FOR FINISHES: As a master format for construction projects, to identify interior and exterior material finishes for type, texture, patterns, color and placement.
- D. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.
- E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
- F. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
- G. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- H. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.
- I. Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY: Requirements for installing the over-current protective devices to ensure proper equipment and personnel protection.

- J. Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low voltage transformers.
- K. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
- L. Section 26 43 13, TRANSIENT-VOLTAGE SURGE SUPPRESSION: Surge suppressors installed in panelboards.
- M. Section 26 51 00, INTERIOR LIGHTING: Fixture and ballast type for interior lighting.
- N. VA Barrier Free Design Handbook (H-18-13)

1.3 QUALIFICATIONS

- A. Approval by the Contracting Officer is required for products and services of proposed manufacturers, suppliers and installers and shall be contingent upon submission by Contractor of certificates stating the following:
 - 1. Elevator contractor is currently and regularly engaged in the installation of elevator equipment as one of his principal products.
 - 2. Elevator contractor shall have three years of successful experience, trained supervisory personnel, and facilities to install elevator equipment specified herein.
 - 3. The installers shall be Certified Elevator Mechanics with technical qualifications of at least five years of successful experience and Apprentices actively pursuing certified mechanic status. Certificates shall be submitted for all workers employed in this capacity.
 - 4. Elevator contractor shall submit a list of two or more prior hospital installations where all the elevator equipment he proposes to furnish for this project functioned satisfactorily to serve varying hospital traffic and material handling demands. Provide a list of hospitals that have the equipment in operation for two years preceding the date of this specification. Provide the names and addresses of the Medical Centers and the names and telephone numbers of the Medical Center Administrators.
- B. Approval of Elevator Contractor's equipment will be contingent upon their identifying an elevator maintenance service provider that shall render services within two hours of receipt of notification, together with certification that the quantity and quality of replacement parts stock is sufficient to warranty continued operation of the elevator installation.
- C. Approval will not be given to elevator contractors and manufacturers who have established on prior projects, either government, municipal,

or commercial, a record for unsatisfactory elevator installations, have failed to complete awarded contracts within the contract period, and do not have the requisite record of satisfactorily performing elevator installations of similar type and magnitude.

- D. All electric traction elevators shall be the product of the same manufacturer.
- E. The Contractor shall provide and install only those types of safety devices that have been subjected to tests witnessed and certified by an independent professional testing laboratory that is not a subsidiary of the firm that manufactures supplies or installs the equipment.
- F. Welding at the project site shall be made by welders and welding operators who have previously qualified by test as prescribed in American Welding Society Publications AWS D1.1 to perform the type of work required. Certificates shall be submitted for all workers employed in this capacity. A welding or hot work permit is required for each day and shall be obtained from the COTR of safety department. Request permit one day in advance.
- G. Electrical work shall be performed by Licensed Electricians as requirements by NEC. Certificates shall be submitted for all workers employed in this capacity.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification. Elevator installation shall meet the requirements of the latest editions published and adopted by the United States Department of Veterans Affairs on the date contract is signed.
- B. Federal Specifications (Fed. Spec.):
 - J-C-30B.....Cable and Wire, Electrical (Power, Fixed Installation)
 - W-C-596F.....Connector, Plug, Electrical; Connector, Receptacle, Electrical
 - W-F-406E.....Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible
 - HH-I-558C.....Insulation, Blankets, Thermal (Mineral Fiber, Industrial Type)
 - W-F-408E.....Fittings for Conduit, Metal, Rigid (Thick- Wall and Thin-wall (EMT) Type)
 - RR-W-410.....Wire Rope and Strand
 - TT-E-489J.....Enamel, Alkyd, Gloss, Low VOC Content

QQ-S-766Steel, Stainless and Heat Resisting, Alloys,
Plate, Sheet and Strip

C. International Building Code (IBC)

D. American Society of Mechanical Engineers (ASME):

A17.1-07.....Safety Code for Elevators and Escalators

A17.2-07.....Inspectors Manual for Electric Elevators and Escalators

E. National Fire Protection Association:

NFPA 13-10.....Standard for the Installation of Sprinkler Systems

NFPA 70-11.....National Electrical Code (NEC)

NFPA 72-10.....National Fire Alarm and Signaling Code

NFPA 101-09.....Life Safety Code

NFPA 252-08.....Fire Test of Door Assemblies

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

A1008/A1008M-10.....Steel, Sheet, Cold Rolled, Carbon, Structural,
High-Strength Low-Alloy and High Strength Low-
Alloy with Improved Formability

E1042-02(R2008).....Acoustically Absorptive Materials Applied by
Trowel or Spray

G. Society of Automotive Engineers, Inc. (SAE)

J517-10.....Hydraulic Hose, Standard

H. Gauges:

For Sheet and Plate: U.S. Standard (USS)

For Wire: American Wire Gauge (AWG)

I. American Welding Society (AWS):

D1.1-10.....Structured Welding Code Steel

J. National Electrical Manufacturers Association (NEMA):

LD-3-05.....High-Pressure Decorative Laminates

K. Underwriter's Laboratories (UL):

486A-03.....Safety Wire Connectors for Copper Conductors

797-07.....Safety Electrical Metallic Tubing

L. Institute of Electrical and Electronic Engineers (IEEE)

M. Regulatory Standards:

Uniform Federal Accessibility Standards

Americans with Disabilities Act

1.5 SUBMITTALS

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

- B. Before execution of work, furnish information to evidence full compliance with contract requirements for proposed items. Such information shall include, as required: Manufacturer's Name, Trade Names, Model or Catalog Number, Nameplate Data (size, capacity, and rating) and corresponding specification reference (Federal or project specification number and paragraph). All submitted drawings and related elevator material shall be forwarded to the Contracting Officer.
- C. Shop Drawings:
1. Complete scaled and dimensioned layout in plan and section view showing the arrangement of equipment and all details of each and every elevator unit specified including:
 - a. Hoisting machines, controllers, power conversion devices, governors, and all other components located in machine room.
 - b. Car, counterweight, sheaves, supporting beams, guide rails, brackets, buffers, size of car platform, car frame members, and other components located in hoistway.
 - c. Rail bracket spacing and maximum vertical forces on guide rails in accordance with ASME A17.1 Section 2.23 and Section 8.4.8 for Seismic Risk Zone 2 or greater.
 - d. Reactions at points of supports and buffer impact loads.
 - e. Weights of principal parts.
 - f. Top and bottom clearances and over travel of car and counterweight.
 - g. Location of shunt trip circuit breaker, switchboard panel, light switch, and feeder extension points in the machine room.
 2. Drawings of hoistway entrances and doors showing details of construction and method of fastening to the structural members of the building.
 - a. If drywall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and drywall.
 - b. Sill details including sill support.
- D. Samples:
1. One each of stainless steel, 75 mm x 125 mm (3 in. x 5 in.).
 2. One each of baked enamel, 75 mm x 125 mm (3 in. x 5 in.).
 3. One each of color vinyl floor tile.
 4. One each of protection pads, 75 mm x 125 mm (3 in. x 5 in.) if used.
 5. One each car and hoistway Braille plate sample.

6. One each car and hall button sample.
 7. One each car and hall lantern/position indicator sample.
 8. One each wall and ceiling material finish sample.
 9. One each car lighting sample.
 10. No other samples of materials specified shall be submitted unless specifically requested after submission of manufacturer's name. If additional samples are furnished pursuant to request, adjustment in contract price and time will be made as provided in Section 00 72 00, GENERAL CONDITIONS.
- E. Name of manufacturer, type or style designation, and applicable data of the following equipment shall be shown on the elevator layouts:
1. Hoisting Machine.
 2. Hoisting Machine Motor, HP and RPM ratings, Voltage, Starting and Full Load Ampere, and Number of Phases.
 3. Controller
 4. Starters and Overload Current Protection Devices.
 5. Car Safety Device; maximum and minimum rated loads and rated speeds.
 6. Governor
 7. Electric Door Operator; HP and RPM ratings, Voltage and Ampere rating of motor.
 8. Hoistway Door Interlocks.
 9. Car and Counterweight Buffers; maximum and minimum rated loads, maximum rated striking speed and stroke.
 10. Hoist and Compensation Ropes; ultimate breaking strength, allowable working load, and actual working load.
 11. Cab Ventilation Unit; HP rating and CFM rating.
- F. Complete construction drawings of elevator car enclosure, showing dimensioned details of construction, fastenings to platform, car lighting, ventilation, ceiling framing, top exits, and location of car equipment.
- G. Complete dimensioned detail of vibration isolating foundations for traction hoisting machines.
- H. Dimensioned drawings showing details of:
1. All signal and operating fixtures.
 2. Car and counterweight roller guides.
 3. Hoistway door tracks, hangers, and sills.
 4. Door operator, infrared curtain units.
- I. Drawings showing details of controllers and supervisory panels.

J. Furnish certificates as required under: Paragraph "QUALIFICATIONS".

1.6 WIRING DIAGRAMS

- A. Provide three complete sets of field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway, machine room and fixtures. Install one set coated with an approved plastic sealer and mounted in the elevator machine room as directed by the Contracting Officer Representative.
- B. In the event field modifications are necessary during installation, diagrams shall be revised to include all corrections made prior to and during the final inspection. Corrected diagrams shall be delivered to the Contracting Officer Representative within thirty (30) days of final acceptance.
- C. Provide the following information relating to the specific type of microprocessor controls installed:
 - 1. Owner's information manual, containing job specific data on major components, maintenance, and adjustment.
 - 2. System logic description.
 - 3. Complete wiring diagrams needed for field troubleshooting, adjustment, repair and replacement of components. Diagrams shall be base diagrams, containing all changes and additions made to the equipment during the design and construction period.
 - 4. Changes made during the warranty period shall be noted on the drawings in adequate time to have the finalized drawings reproduced for mounting in the machine room no later than six months prior to the expiration of the warranty period.

1.7 ADDITIONAL EQUIPMENT

- A. Additional equipment required to operate the specified equipment manufactured and supplied for this installation shall be furnished and installed by the contractor. The cost of the equipment shall be included in the base bid.
- B. Equipment not required by specification, which would improve the operation, may be installed in conjunction with the specified equipment by the contractor at his option at no additional cost to the Government, provided prior approval is obtained from the Contracting Officer's Technical Representative.

1.8 TOOL CABINET

- A. Provide a metal parts/tool cabinet, having two shelves and hinged doors. Cabinet size shall be 1220 mm (48 in.) high, 762 mm (30 in.) wide, and 457 mm (18 in.) deep.

1.9 PERFORMANCE STANDARDS

- A. The elevators shall be capable of meeting the highest standards of the industry and specifically the following:
 - 1. Contract speed is high speed in either direction of travel with rated capacity load in the elevator. Speed variation under all load conditions, regardless of direction of travel, shall not vary more than three (3) percent.
 - 2. The controlled rate of change of acceleration and retardation of the car shall not exceed 0.1G per second and the maximum acceleration and retardation shall not exceed 0.2G per second.
 - 3. Starting, stopping, and leveling shall be smooth and comfortable without appreciable steps of acceleration and deceleration.
- B. The door operator shall open the car door and hoistway door simultaneously at 2.5-feet per second and close at 1-foot per second.
- C. Elevator control system shall be capable of starting the car without noticeable "roll-back" of hoisting machine sheave, regardless of load condition in car, location of car, or direction of travel.
- D. Floor level stopping accuracy shall be within 3 mm (1/8 in.) above or below the floor, regardless of load condition.
- E. Noise and Vibration Isolation: All elevator equipment including their supports and fastenings to the building, shall be mechanically and electrically isolated from the building structure to minimize objectionable noise and vibration transmission to car, building structure, or adjacent occupied areas of building.
- F. Sound Isolation: Noise level relating to elevator equipment operation in machine room shall not exceed 80 dBA. All dBA readings shall be taken three (3) feet off the floor and three (3) feet from equipment.
- G. Airborne Noise: Measured noise level of elevator equipment during operation shall not exceed 50 dBA in elevator lobbies and 60 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.

1.10 WARRANTY

- A. Submit all labor and materials furnished in connection with elevator system and installation to terms of "Warranty of Construction" articles

of FAR clause 52.246-21. The one year Warranty shall commence after final inspection, completion of performance test, and upon full acceptance of the installation and shall concur with the guarantee period of service.

- B. During warranty period if a device is not functioning properly or in accordance with specification requirements, or if in the opinion of the Contracting Officer's Technical Representative, excessive maintenance and attention must be employed to keep device operational, device shall be removed and a new device meeting all requirements shall be installed as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Where stainless steel is specified, it shall be corrosion resisting steel complying with Federal Specification QQ-S-766, Class 302 or 304, Condition A with Number 4 finish on exposed surfaces. Stainless steel shall have the grain of belting in the direction of the longest dimension and surfaces shall be smooth and without waves. During installation all stainless steel surfaces shall be protected with suitable material.
- B. Where cold rolled steel is specified, it shall be low-carbon steel rolled to stretcher leveled standard flatness, complying with ASTM A109.

2.2 MANUFACTURED PRODUCTS

- A. Materials, devices, and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items. Items not meeting this requirement, but meet technical specifications which can be established through reliable test reports or physical examination of representative samples, will be considered.
- B. When two or more devices of the same class of materials or equipment are required, these units shall be products of one manufacturer.
- C. Manufacturers of equipment assemblies which include components made by others shall assume complete responsibility for the final assembled unit.

1. Individual components of assembled units shall be products of the same manufacturers.
 2. Parts which are alike shall be the product of a single manufacturer.
 3. Components shall be compatible with each other and with the total assembly for the intended service.
- D. Motor nameplates shall state manufacturers' name, rated horsepower, speed, volts, starting and full load amperes, and other characteristics required by NEMA Standards and shall be securely attached to the item of equipment in a conspicuous location.
- E. The elevator equipment, including controllers, door operators, and supervisory system shall be the product of manufacturers of established reputation, provided such items are capably engineered and produced under coordinated specifications to ensure compatibility with the total operating system. Mixing of manufactures related to a single system or group of components shall be identified in the submittals.
- F. Where key operated switches are furnished in conjunction with any component of this elevator installation, furnish four (4) keys for each individual switch or lock. Provide different key tumblers for different switch and lock functions. Each and every key shall have a tag bearing a stamped or etched legend identifying its purpose. Barrel key switches are not acceptable, except where required by code.
- G. If the elevator equipment to be installed is not known to the Contracting Officer Representative, the Contractor shall submit drawings in triplicate for approval to the Contracting Officer Representative, Contracting Officer, and VA CFM Elevator Engineer showing all details and demonstrate that the equipment to be installed is in strict accordance with the specifications.

2.3 CAPACITY, SIZE, SPEED, AND TRAVEL

- A. Each and every elevator shall have the capacity to lift and lower the live load, including the weight of the car and cables, at the speed specified in the following schedule:

ELEVATOR SCHEDULE	
Elevator Number	P1 (Elev 1) and P2 (Elev 2)
Overall Platform Size	3.92 square meters (42.2 square feet)
Rated Load - kg (lb)	4,000

ELEVATOR SCHEDULE	
Contract Speed - m/s(fpm)	1.75m/s (350 fps)
Number of Stops	3
Number of Openings	3
Type of Roping	1/2"x8x19 preformed traction steel hoist ropes
Entrance Type and Size	Elevator 1: Center Elevator 2: Side

2.4 POWER SUPPLY

- A. For power supply in each machine room, see Specification 26 05 21, Electrical specifications, and Electrical drawings.
- B. It shall be the Electrical contractor's responsibility to supply the labor and materials for the installation of the following:
 - 1. Feeders from the power source indicated on the drawings to each elevator controller.
 - 2. Shunt Trip Circuit Breaker for each controller shall be located inside machine room at the strike side of the machine room door and lockable in the "Off" position.
 - 3. Provide Surge Suppressors to protect the elevator equipment.
- C. Power for auxiliary operation of elevator as specified shall be available from auxiliary power generator, including wiring connection to the elevator control system.

2.5 CONDUIT AND WIREWAY

- A. Unless otherwise specified or approved, install electrical conductors, except traveling cable connections to the car, in rigid zinc-coated steel or aluminum conduit, electrical metallic tubing or metal wireways. Rigid conduits smaller than 3/4 inch or electrical metallic tubing smaller than 1/2 inch electrical trade size shall not be used. All raceways completely embedded in concrete slabs, walls, or floor fill shall be rigid steel conduit. Wireway (duct) shall be installed in the hoistway and to the controller and between similar apparatus in the elevator machine room. Fully protect self-supporting connections, where approved, from abrasion or other mechanical injury. Flexible metal conduit not less than 3/8 inch electrical trade size may be used, not exceeding 18 inches in length unsupported, for short connections between risers and limit switches, interlocks, and for other applications permitted by NEC.

- B. All conduits terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulation bushings. Install a steel lock nut under the bushings if they are constructed completely of insulating materials. Protect the conductors at ends of conduits not terminating in steel cabinets or boxes by terminal fittings having an insulated opening for the conductors.
- C. Rigid conduit and EMT fittings using set screws or indentations as a means of attachment shall not be used. All fittings shall be steel or malleable iron.
- D. Connect motor or other items subject to movement, vibration or removal to the conduit or EMT systems with flexible, steel conduits.
- E. Conduit, junction boxes, outlet boxes, etc., shall be sized for future travel requirements of two additional floors.

2.6 CONDUCTORS

- A. Unless otherwise specified, conductors, excluding the traveling cables, shall be stranded or solid coated annealed copper in accordance with Federal Specification J-C-30B for Type RHW or THW. Where 16 and 18 AWG are permitted by NEC, single conductors or multiple conductor cables in accordance with Federal Specification J-C-580 for Type TF may be used provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant. Multiple conductor cable shall have color or number coding for each conductor. Conductors for control boards shall be in accordance with NEC. Joints or splices are not permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.
- B. Provide all conduit and wiring between machine room, hoistway and fixtures.
- C. All wiring must test free from short circuits or ground faults. Insulation resistance between individual external conductors and between conductors and ground shall be a minimum of one megohm.
- D. Where size of conductor is not given, voltage and amperes shall not exceed limits set by NEC.
- E. Provide equipment grounding. Ground the conduits, supports, controller enclosure, motor, platform and car frame, and all other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires shall be copper, green insulated and sized as

required by NEC. Bond the grounding wires to all junction boxes, cabinets, and wire raceways.

- F. Terminal connections for all conductors used for external wiring between various items of elevator equipment shall be solderless pressure wire connectors in accordance with Federal Specification W-S-610. The Elevator Contractor may, at his option, make these terminal connections on 10 gauge or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce-through serrated washers are not acceptable.

2.7 TRAVELING CABLES

- A. All conductors to the car shall consist of flexible traveling cables conforming to the requirements of NEC. Traveling cables shall run from the junction box on the car directly to the controller. Junction boxes on the car shall be equipped with terminal blocks. Terminal blocks having pressure wire connectors of the clamp type that meet UL 486A requirements for stranded wire may be used in lieu of terminal eyelet connections. Terminal blocks shall have permanent indelible identifying numbers for each connection. Cables shall be securely anchored to avoid strain on individual terminal connections. Flame and moisture resistant outer covering must remain intact between junction boxes. Abrupt bending, twisting and distortion of the cables shall not be permitted.
- B. Provide spare conductors equal to 10 percent of the total number of conductors furnished, but not less than 5 spare conductors in each traveling cable.
- C. Provide shielded wires for the auto dial telephone system within the traveling cable. Add 5 pair shielded wires for card reader, 2 RG-6/U coaxial CCTV cables, and 2 pair 14 gauge wires for CCTV power as needed.
- D. If traveling cables come into contact with the hoistway or elevator due to sway or change in position, provide shields or pads to the elevator and hoistway to prevent damage to the traveling cables.
- E. Hardware cloth wide may be installed from the hoistway suspension point downward to the elevator pit to prevent traveling cables from rubbing or chafing. Hardware cloth shall be securely fastened and tensioned to prevent buckling. Hardware cloth is not required when traveling cable is hung against a flat wall.

2.8 CONTROLLER AND SUPERVISORY PANEL

- A. UL/CSA Labeled Controller: Mount all assemblies, power supplies, chassis switches, and relays on a self-supporting steel frame. Completely enclose the equipment and provide a mean to control the temperature. Solid state components shall be designed to operate between 32 to 104 degrees Fahrenheit, humidity non-condensing up to 85 percent.
- B. All controller switches and relays shall have contacts of design and material to ensure maximum conductivity, long life and reliable operation without overheating or excessive wear, and shall provide a wiping action to prevent sticking due to fusion. Switches carrying highly inductive currents shall be provided with arc shields or suppressors.
- C. Where time delay relays are used in the circuits, they shall be of acceptable design, adjustable, reliable, and consistent such as condenser timing or electronic timing circuits.
- D. Properly identify each device on all panels by name, letter, or standard symbol which shall be neatly stencil painted or decaled in an indelible and legible manner. Identification markings shall be coordinated with identical markings used on wiring diagrams. The ampere rating shall be marked adjacent to all fuse holders. All spare conductors to controller and supervisory panel shall be neatly formed, laced, and identified.
- E. Controller shall be provided with wiring and components for additional future travel of 2 floors and approximate 24 feet of travel.

2.9 MICROPROCESSOR CONTROL SYSTEM

- A. Provide a microprocessor based system with absolute position/speed feedback encoded tape to control the hoisting machine and signal functions in accordance with these specifications. Complete details of the components and printed circuit boards, together with a complete operational description, shall be submitted for approval.
 - 1. All controllers shall be non-proprietary.
 - 2. Proprietary tools shall not be necessary for adjusting, maintenance, repair, and testing of equipment.
 - 3. Controller manufacturer shall provide factory training, engineering and technical support, including all manuals and wiring diagrams to the VA Medical Center's designated Elevator Maintenance Service Provider.

4. Replacement parts shall be shipped overnight within 48 hours of an order being received.
- B. All controller assemblies shall provide smooth, step-less acceleration and deceleration of the elevator, automatically and irrespective of the load in the car. All control equipment shall be enclosed in metal cabinets with lockable, hinged door(s) and shall be provided with a means of ventilation. All non-conducting metal parts in the machine room shall be grounded in accordance with NEC. Cabinet shall be securely attached to the building structure.
- C. Circuit boards for the control of each and every elevator system; dispatching, signals, door operation and special operation shall be installed in a NEMA Type 1 General Purpose Enclosure. Circuit boards shall be moisture resistant, non-corrosive, non-conductive, fabricated of non-combustible material and adequate thickness to support the components mounted thereon. Mounting racks shall be spaced to prevent accidental contact between individual circuit boards and modules.
- D. Modules shall be the type that plug into pre-wired mounting racks. Field wiring or alteration shall not be necessary in order to replace defective modules.
- E. Each device, module and fuse (with voltage and ampere rating) shall be identified by name, letter or standard symbol in an approved indelible and legible manner on the device or panel. Coordinate identification markings with identical markings on wiring diagrams.
- F. The electrical connections between the printed circuit boards (modules) and the circuit connectors incorporated in the mounting racks shall be made through individual tabs which shall be an integral part of each module. The tabs shall be nickel-gold plated or other approved metal of equal electrical characteristics. Modules shall be keyed or notched to prevent insertion of the modules in the inverted position.
- G. Light emitting diodes (LED) shall be for visual monitoring of individual modules.
- H. Components shall have interlocking circuits to assure fail-safe operation and to prevent elevator movement should a component malfunction.
- I. Method of wire wrapping from point to point with connections on the mounting racks shall be submitted for approval.
- J. Field wiring changes required during construction shall be made only to the mounting rack connection points and not to the individual module

circuitry or components. If it is necessary to alter individual modules they shall be returned to the factory where design changes shall be made and module design records changed so correct replacement units will be available.

- K. All logic symbols and circuitry designations shall be in accordance with ASME and NEC Standards.
- L. Solid state components shall be designed to operate within a temperature range of 32 to 104 degrees Fahrenheit, humidity non-condensing up to 85 percent.
- M. Wiring connections for operating circuits and for external control circuits shall be brought to terminal blocks mounted in an accessible location within the controller cabinet. Terminal blocks using pierce through serrated washers shall not be used.

2.10 VVVF AC MOTOR CONTROL WITH REGENERATIVE DRIVE

- A. Variable Voltage Variable Frequency Motor Control:
 - 1. Elevator control shall be affected by means of a compact solid state motor control unit for each and every elevator with electrical characteristics to suit the power supply. The system shall consist of the necessary three phase, full-wave bridge rectifiers and be equipped with regenerative drive.
 - 2. Solid state motor control unit shall operate with high efficiency and low power consumption, have the capacity to handle peak currents typical of elevator service and contain a balanced, coordinated fault protection system which shall accomplish the following:
 - a. Protect the complete power circuit and specifically the power semi-conductors from failure under short circuit (bolted fault) conditions.
 - b. Protect against limited faults arising from partial grounds, partial shorts in the motor armature or in the power unit itself.
 - c. Protect the drive motor against sustained overloads. A solid state overload circuit shall be used.
 - d. Protect motor and power unit against instantaneous peak overload.
 - e. Provide semi-conductor transient protection.
 - f. Provide phase sequence protection to ensure incoming line is phased properly.
 - g. Removable printed circuit boards shall be provided for the VVVF control. Design tabs so boards cannot be reversed.

2.11A AUXILIARY POWER OPERATION

- A. The control system for Elevators P1 through P2, shall provide for the operation of one car per elevator bank on auxiliary power upon failure of the normal power supply.
- B. Auxiliary power supply, its starting means, transfer switch for transfer of elevator supply from normal to auxiliary power, two pair of conductors in a conduit from an auxiliary contact on the transfer switch (open or close contacts as required by Controller Manufacturer) to terminals in the group elevator controller and other related work shall be provided by the Electrical Contractor.
- C. Auxiliary equipment on elevator controllers, wiring between associated elevator controllers and wiring between elevator controllers and remote selector panel as required to permit the elevators to operate as detailed, shall be provided by the Elevator Contractor.
- D. Upon loss of normal power supply there shall be a delay before transferring to auxiliary power of 10 seconds minimum to 45 seconds maximum, the delay shall be accomplished through an adjustable timing device. Following this adjustable delay the associated elevators shall function as follows:
 - 1. Selector switch, Automatic position:
 - a. Not more than one elevator at a time in each group shall be automatically selected and returned to the main floor, at normal speed, cycle its car and hoistway doors and shut down, with "Door Open" button remaining operable.
 - b. As each elevator reaches the designated floor and shuts down, another elevator shall start and return to the designated floor.
 - c. Elevators that have been manually removed from automatic service and are on independent service, fire service or medical emergency shall receive an automatic return signal. Elevators on inspection service or out of service shall not receive a signal.
 - d. When an elevator is given a signal to return and it is unable to start its movement to the designated floor within 30 seconds it shall be by-passed. When an elevator is by-passed, another elevator shall start and return.
 - e. This process shall continue until all elevators have returned to the designated floor and shut down.
 - f. Any elevator or elevators by-passed on initial return signal shall be signaled again.

- g. When all cars in group have returned to designated floor, one elevator in each group shall be designated for automatic operation. Individual cars in each group shall restart at 5 second intervals.
- 2. Selector switch, Manual operation:
 - a. Selector switch shall be mechanically and electrically interlocked to prevent the selection of more than one elevator from operating on auxiliary power.
 - b. The selector switch shall have positions marked with the number of each elevator controlled. It shall also have a position marked "Automatic". When the selector switch is set to the automatic position, the medical emergency service car shall operate on auxiliary power operation, or if none, the last car arriving at the designated floor shall operate on auxiliary power operation.
 - c. Change in selection of elevators shall be by means of the selection switch and shall occur only when the previous selected elevator is stopped at the designated floor.
 - d. The selector switch shall be locked out of operation when the system is in the normal mode of operation.
 - e. Locate the selector switch above the hall push button station at the designated level in a NEMA 1B flush type enclosure furnished with a brushed finish stainless steel hinged door and frame. The door shall contain a tumbler type lock furnished with four keys. The enclosure faceplate shall be identified "Auxiliary Power Control" with 13 mm (1/2 in.) engraved letters filled with black paint.
- 3. The inside of the selector panel shall be brushed finish stainless steel with each device identified with 3 mm (1/8 in.) engraving filled with black paint. The panel shall contain:
 - a. Selector switch for selecting the elevators shall be toggle or rotary type switch.
 - b. Pilot lights to indicate normal mode of operation, auxiliary power service available, and which elevator or elevators in each group is connected to auxiliary service.
 - c. A lamp test circuit consisting of a momentary contact push button to test all pilot lights in the circuit.

- d. Provide a permanently mounted, easy to read, instruction plate which shall include operating instructions for auxiliary power service and instructions for lamp test circuits.
- E. Prior to the return of normal power an adjustable timed circuit shall be activated that will cause all cars to remain at a floor if already there or stop and remain at the next floor if in flight. Actual transfer of power from auxiliary power to normal building power shall take place after all cars are stopped at a floor with their doors open.
- F. Car lighting circuits shall be connected to the auxiliary power panel.

2.11B EMERGENCY RESCUE OPERATION

- A. Provide a power source to send the elevator to the nearest landing. After the elevator has leveled at the nearest landing, provide power to open the car and hoistway doors automatically. After a predetermined time the doors shall close. Power shall stay applied to the door open button so the doors can be opened from the inside of the elevator. The elevator shall remain shut down at the landing until normal power is restored. Install a sign on the controller indicating that the power is applied to emergency rescue operator and door operator during loss of normal power.

2.12A DUPLEX SELECTIVE COLLECTIVE AUTOMATIC OPERATION

- A. Provide duplex selective collective automatic operation, for passenger elevators P1 and P2.
- B. Operate elevators from push buttons inside the cars and located at each and every floor between elevators. When cars are available, park one car at main floor (home car) and the other car at last call (free car). Respond to car calls and hall calls above main floor using the "free" car. Once a car has started, respond to registered calls in the direction of travel and in the order the floors are reached. Do not reverse the car direction until all car calls have been answered, or until all hall calls ahead of the car and corresponding to the direction of car travel have been answered.

Slow and stop elevators automatically at floors corresponding to registered calls in the order in which they are approached in each direction of travel. As slowdown is initiated, automatically cancel the hall call and car call. Hold car at arrival floor an adjustable time interval to allow passenger transfer.

When the "free" car is clearing calls, the "home" car shall respond to the following:

1. Calls registered on "home" car push buttons.
 2. Up hall calls registered below "free" car.
 3. Up or down calls registered above "free" car while "free" car is traveling down.
 4. Hall calls when "free" car is delayed in its normal operation for a predetermined period.
- C. When both cars are clearing calls, stop only one car in response to any registered hall call. Return the first car to clear its calls to the main floor. Should last service required bring both cars to main floor, the first arriving car becomes the "free" car. Illuminate floor push button to indicate call registration. Extinguish light when call is answered.
- D. If a landing button is operated while the car and hoistway doors are closing at that floor, the call shall be registered for the next available elevator. Calls registered shall be canceled if closing doors are reopened by means of "DOOR OPEN" button or infrared curtain unit.
- E. When an elevator is delayed for a predetermined time interval or shuts down after it receives a start signal, the system shall automatically permit the remaining car in the group to respond to hall calls and to be dispatched in normal manner. When cause of delay is corrected, car shall automatically resume normal operation unless it has been manually removed from the system.
- F. Auxiliary Landing Call Operation: In the event of corridor call button circuit failure, elevators are to service each floor in both directions in a predetermined pattern without registration of a call within the elevators. Provide illuminated signal in each the controller to indicate that emergency dispatch operation is in effect. Restoration of the landing call button system shall cause normal operation to resume.
- G. Car lights and fan in the elevator shall not shut off when elevator is idle. Arrange circuits so that power to lights and outlets on top and bottom of car shall not be interrupted.

2.12B MACHINE ROOM MONITOR (CCTV): GROUP OPERATION

- A. Install a monitor in the machine room located in the Group Dispatch Operation Cabinet. Provide separate cabinets for the passenger elevator group and for the service elevator group. Provide one keyboard for each terminal.

B. The CCTV shall contain indicators to provide the following information:

1. The floor where each elevator is currently located.
2. The direction that each elevator is currently traveling or is scheduled to travel.
3. The location and direction of currently registered hall calls.
4. Elevators that are currently out of service.
5. Elevators that are currently bypassing hall calls.
6. Elevators that are currently engaged in passenger transfers.
7. Operations program under which entire group is currently operating.
8. Zone divisions of the entire group.
9. Door positions.
10. Status indication for cars on independent service, car top inspection, stop switch activated, alarm activated, fire service, and earthquake protection activated, etc.

C. The maintenance terminal shall be suitable for all troubleshooting procedures related to the specific type microprocessor installed on this project.

2.13 LOAD WEIGHING

- A. Provide means for weighing car load for each and every elevator. When load in a car reaches an adjustable predetermined level of the rated capacity, that car shall bypass registered landing calls until the load in the car drops below the predetermined level. Calls bypassed in this manner shall remain registered for the next car. The initial adjustment of the load weighting bypass setting shall be 60 to 100 percent.

2.14 ANTI-NUISANCE FEATURE

- A. If weight in the car is not commensurate with the number of registered car calls, cancel car calls. Systems that employ either load weighing or door protective device for activation of this feature are acceptable.

2.15 FIREFIGHTERS' SERVICE

- A. Provide Firefighters' Service as per ASME A17.1 Section 2.27.
- B. Smoke Detectors:
1. Smoke detection devices that are designated for actuation of Elevator Phase I "FIRE SERVICE" response in each elevator lobby, top of hoistway, and machine room shall be provided by others.
 - a. Elevator lobby smoke detectors shall activate only the elevators sharing the corresponding or common lobby.

- b. Top of hoistway smoke detectors shall activate fire recall and the top of hoistway motorized vent.
- c. Elevator or group of elevators serving separate isolated areas of the same floor shall have an independent smoke detection system.
- d. Machine room smoke detectors shall activate fire recall for each and every elevator with equipment located in that machine room.
- e. Hoistway ventilation, provided by others, located at the top of hoistway for elevators that penetrate more than three floors and meets the requirements of ASME A17.1 Section 2.1.4 and IBC Section 3004. The vent shall stay closed under power. When the top of hoistway smoke detector is activated, the power is removed from the vent and the vent shall open. When the smoke detector is reset, the vent shall close by power.

2.16 SEISMIC REQUIREMENTS

- A. Meet the requirements of ASME A17.1 Section 8.4, Elevator Safety Requirements for Seismic Risk Zone 2 or greater and VA Seismic Design Manual H-18-8.
- B. Support and maintain hoisting machines, controllers, supervisory panels, governors, pit sheaves, car and counterweight rails and brackets, conduit systems, buffers, and compensation sheaves in place to prevent any component from sliding, rotating, overturning, or jumping under conditions imposed by seismic forces not less than that required to produce an acceleration of gravity horizontally and 1/2 gravity vertically acting simultaneously. Design the total system to continue operation without interruption under specified seismic acceleration, as outlined in H-18-8.
- C. Support all vertical conduits or duct systems within the hoistway at points above the center of gravity of the riser. Provide lateral guides at regular intervals.
- D. Provide hoisting machines mounted on vibration isolators with separate isolated seismic restraints.
- E. Controllers and supervisory panel shall be bolted to the floor, and provided with sway braces at the top. Secure all electrical components within the panels to the panel frame. Fit cabinet doors with positive locking latches.

- F. Car and counterweight guide rail brackets and rail clip bolts shall be guarded against snagging the traveling cables on the side of the rail adjacent to the point of suspension of the traveling cables.
- G. Provide car guide rails with at least one intermediate bracket between brackets located at each floor so that bracket spacing does not exceed 2440 mm (8 ft). If intermediate brackets cannot be installed because of lack of structural support, reinforce rails with 229 mm (9 in.) channel or approved equal backing.
- H. Guide rails shall not be less than 22.5 kg/m (15 lb/ft).
- I. Provide counterweight guide rails with intermediate brackets in sufficient number so that the counterweight frame shall span no less than two brackets in its full length anywhere in the hoistway. Each pair of intermediate brackets as well as brackets located at each floor line shall have a horizontal tie of sufficient strength to contain the counterweight. Locate the horizontal tie member between the counterweight and the elevator car, and do not attach to the car guide rail or channel backing.
- J. Provide two counterweight derailment sensing wires vertically on the car side of the counterweight the entire height of travel. The counterweight frame shall be equipped with four derailment rings. Provide counterweight displacement switch. In the event the switch is activated, the corresponding elevator shall stop immediately and then proceed in the direction away from the counterweight to the next floor at a speed not exceeding 0.76 m/s (150 FPM). Upon arrival at the next floor, the elevator shall shut down with its door open. An indicator pilot light shall illuminate when the counterweight derailment detector is activated. This pilot shall be fully identified and shall be located in the machine room indicator panel, or if no machine room indicator panel is specified, locate pilot light in a conspicuous place on the front of the elevator controller, not obstructed by controller door panels.
- K. Provide seismic switch to activate seismic operation, a minimum of one seismic switch per elevator or group of elevators.
- L. Provide an Annunciator in machine room connected to the essential electrical system. Annunciator will indicate if the seismic switch is not operative due to loss of power.
- M. Provide a sensor switch, installed on the governor rope tail sheave, to signal when the governor tail sheave is dislodged. The sensor shall

prevent car movement when the governor tail sheave is dislodged from its normal position.

- N. The stresses in parts of structural members made of steel shall not exceed 88 percent of the minimum elastic strength of the material used in the fastenings.
- O. Provide car enclosure ceiling panels and fluorescent tubes with latching devices that shall restrain the panels and fluorescent tubes. Devices shall be readily removable for cleaning or replacing panels and re-lamping.
- P. Submittals are required for all equipment anchors, supports, restraints and detectors. Submittals shall include weight, dimensions, center of gravity, standard connections, calculations, manufacturer's recommendations, behavior problems (vibration, thermal, expansion, etc.) so that design can be properly reviewed.
- Q. California only: provide an Earthquake Detection device in machine room to activate "GO SLOW ELEVATORS" operation. The following are references:
 - 1. Emergency Service:
 - a. Earthquake emergency operation Section 304(d)
 - b. Title 8, Industrial Relations, Division 01
 - c. Department of Industrial Relations, Chapter 4
 - d. Division of Industrial Safety and Sub Chapter 6, Elevator Safety Order

2.17 ELEVATOR MACHINE BEAMS

- A. Overhead beams shall meet the requirements of ASME A17.1 Section 2.9 to support machines and machinery in place to prevent any part from becoming loose or displaced under the conditions imposed in service. Machine beams shall be designed as follows:
 - 1. The load resting on the beams and supports shall include the complete weight of the machine, sheaves, controller, governor, and any other equipment, together with the portion of the machine room floor supported by the beams.
 - 2. Two times the sum of the tensions in all wire ropes supported by the beams with rated load in the car.

2.18 GEARLESS AND GEARED TRACTION MACHINE

- A. Gearless Traction Hoist Machine:

1. Gearless traction machine with an AC motor, brake, drive sheave, and deflector sheave mounted in proper alignment on an isolated bedplate.
2. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.
3. Armature must be electrically balanced and together with motor coupling and brake, mechanically balanced.
4. The structural design of the motor shall ensure perfect alignment of bearings. The rotating elements shall be dynamically balanced to minimize vibration.
5. Hoist machine shaft shall be supported by two bearings mounted on a bedplate or integral with machine frame. Shaft shall be of forged steel or close grain electric furnace cast steel.
6. Drive sheaves shall be free from cracks, sand holes, and other imperfections that would tend to injure the hoist ropes. Sheave shall be turned smooth and true with rope grooves of proper design to ensure maximum traction and maximum life of the hoist ropes. Traction sheave shall be mechanically coupled to the hoist motor shaft centered in a positive manner.
7. Hoisting machine brake shall be drum or disc type and shall have the capacity to hold the elevator with 125 percent of rated load. Arrange brake circuits so that no current shall be applied to the brake coil prior to the establishment of the hoistway door interlock circuit, except during leveling, re-leveling, and hoistway access operation.

B. Geared Traction Hoist Machine:

1. Worm geared tractiontype with an AC motor, brake, gear, drive shaft, deflector sheave, and gear case mounted in proper alignment on an isolated bedplate.
2. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.
3. Armature must be electrically balanced and together with motor coupling and brake, mechanically balanced.
4. The structural design of the motor shall ensure perfect alignment of bearings. The rotating elements shall be dynamically balanced to minimize vibration.

5. Thrust bearings shall be ball, roller, or radial type, of the highest grade, designed to take thrust in both directions. Motor and sheave bearings shall be ball or roller type. Bearings shall be of ample size, self-aligning or pre-loaded, non-adjustable and arranged to eliminate backlash.
6. Hoisting machine brake shall be drum or disc type and shall have the capacity to hold the elevator with 125 percent of rated load. Arrange brake circuits so that no current shall be applied to the brake coil prior to the establishment of the hoistway door interlock circuit, except during leveling, re-leveling, and hoistway access operation.
7. Provide hoist machine drip pans to collect lubricant seepage.

2.20 SHEAVES

- A. Provide deflector sheaves with a metal basket type guard mounted below the sheave and a guard to prevent ropes from jumping out of grooves. Securely fasten guard to sheave beams.
- B. Two-to-one idler sheaves on car and counterweight, if used, shall be provided with metal guards that shall prevent foreign objects from falling between ropes and sheave grooves and accidental contact or injury to workers on top of the car. Fabricate sheave guards from not less than 10-gauge thick steel and install with minimum clearance between guard and cables to prevent ropes from jumping out of grooves.

2.21 HOIST ROPES

- A. Provide elevator with the required number and size of ropes to ensure adequate traction for the range of loads with a factor of safety not less than that required by ASME A17.1 Section 2.20. Hoisting ropes shall be preformed 8 x 19 or 8 x 25 traction steel, conforming to Federal Specification RR-W-410 with minimum nominal diameter of 0.50 inch. For machines located overhead, 6 x 19 preformed traction steel hoisting ropes may be used in lieu of 8 x 19 that meet the requirements of the sheave manufacturer, at the elevator contractor's option.
- B. Securely attach a corrosion resistant metal data tag to one hoisting rope fastening on top of the elevator.
- C. Provide wedge type shackles.

2.22 HOIST ROPE COMPENSATION

- A. Provide compensation when required by controller manufacturer for elevators with travel of 15.15 m (50ft) or more. Compensation shall consist of a necessary number and size of encapsulated chains or

whisper flex attached to the underside of car and counterweight frames. Hoist rope compensation shall meet the requirements of ASME A17.1 Rule 2.21.4.

1. Provide pit guide to minimize chain sway.
2. Provide take-up to compensate for hoist rope stretch.
3. Pad areas where compensation may strike car or hoistway items.

2.23 GOVERNOR ROPE

- A. Governor Rope shall be 6 x 19 or 8 x 19 wire rope, preformed traction steel, uncoated, fiber core, conforming to Federal Specification RR-W-410 with minimum nominal diameter of 0.375 inch having a minimum safety factor of 5. Tiller rope construction is not acceptable.
- B. Under normal operation rope shall run free and clear of governor jaws, rope guards, and other stationary parts.
- C. Securely attach governor rope tag to governor rope releasing carrier. Data tag shall be corrosion-resisting metal and bear data as required by ASME A17.1 Section 2.18.

2.24 SPEED GOVERNOR

- A. Provide Centrifugal type car driven governor, in accordance with ASME A17.1 Section 2.18, to operate the car safety device and counterweight governor to operate the counterweight safety device. Governor shall be complete with weighted pit tension sheave, governor release carrier and mounting base with protected cable sleeves.
- B. Furnish overspeed switch and speed reducing switches when required.
- C. The governor rope clamping device shall be designed so that no appreciable damage to or deformation of the governor rope shall result from the stopping action of the device in operating the safety.
- D. Provide anti-friction metal bearings for the governor and pit tension sheaves. Bearing shall be either self-oiling or Zerk fitting type connections. Ball or roller bearings may be used in lieu of sleeve type.
- E. Provide metal guard over top of governor rope and sheaves.
- F. Governor, with the exception of finished surfaces, screw threads, etc., shall be factory painted and shall operate freely. Field painting of governor parts shall be permitted in accordance with ASME A17.1 Rule 2.18.3.1.
- G. Where the elevator travel does not exceed 100 feet, the weight tension sheave may be mounted on a pivoted steel arm in lieu of operating in steel guides.

2.25 CAR SAFETY DEVICE

- A. Provide "Type B Safeties" on the elevator that meet the requirements of ASME A17.1 Section 2.17.
- B. Field testing of car safety and governor shall be as specified in Section 3.7 PRETEST and TEST of this specification.

2.26 ASCENDING CAR OVERSPEED PROTECTION

- A. Provide a device to prevent ascending over speed and unintended motion away from the landing when the doors are not locked in accordance with ASME A17.1 Section 2.19.

2.27 CAR AND COUNTERWEIGHT BUFFERS

- A. Provide a minimum of two buffers for each car and one for each counterweight that meet the requirements of ASME A17.1 Section 2.22. Securely fasten buffers and supports to the pit channels and in the alignment with striker plates on car and counterweight. Each installed buffer shall have a permanently attached metal plate indicating its stroke and load rating. Buffer anchorage shall not puncture pit waterproofing.
- B. Design and install buffers to provide minimum car runby required by ASME A17.1 Rule 2.4.2.
- C. Furnish pipe stanchions and struts as required to properly support the buffer.

2.28 COUNTERWEIGHTS

- A. Elevator shall be counterweighted with the weight of the car plus 40-50 percent of the rated capacity load as required by the controller manufacturer.
- B. Furnish two (2) tie rods with cotter pins and double nuts at top and bottom. Install counterweight retainer plates or other approved means on tie rods to prevent counterweight sub-weights from jumping and/or rattling. Both ends of tie-rods shall be visible and accessible.
- C. Provide counterweight guards in the pit in accordance with ASME A17.1 Section 2.3.

2.29 CAR AND COUNTERWEIGHT ROLLER/SLIDE GUIDES

- A. Provide car and counterweight with adjustable roller guides.
- B. Each guide shall be of an approved type consisting of not less than three (3) wheels, each with a durable, resilient oil-resistant material tire rotating on ball bearings having sealed-in lubrication. Assemble rollers on a substantial metal base and mount to provide continuous spring pressure contact of all wheels with the corresponding rail

surfaces under all conditions of loading and operation. Secure the roller guides at top and bottom on each side of car frame and counterweight frame. All mounting bolts shall be fitted with nuts, flat washers, split lock washers, and if required, beveled washers.

- C. Provide sheet metal guards to protect wheels on top of car and counterweight.
- D. Minimum diameter of car rollers shall be 150 mm (6 in.) unless the six wheel roller type is used. The entire elevator car shall be properly balanced to equalize pressure on all guide rollers. Cars shall be balanced in post-wise and front-to-back directions. Test for this balanced condition shall be witnessed at time of final inspection.
- E. Minimum diameter of counterweight rollers shall not be less than 75 mm (3 in.). Properly balance counterweight frame to equalize pressure on all guide rollers. The Contractor shall have the option of furnishing, for counterweight only, mechanically adjusted roller guide in lieu of spring loaded roller guides as specified.
- F. Equip all cars and counterweight with an auxiliary guiding device for each guide shoe which shall prevent the car or counterweight from leaving the rails in the event that the normal guides are fractured. These auxiliary guides shall not, during normal operation, touch the guiding surfaces of the rails. Fabricate the auxiliary guides from hot rolled steel plate and mount between the normal guide shoes and the car and counterweight frames. The auxiliary guides may be an extension of the normal guide shoe mounting plate if that plate is fabricated from hot rolled steel. The portion of the auxiliary guide which shall come in contact with the rail guiding surfaces in the event of loss of the normal guides shall be lined with an approved bearing material to minimize damage to the rail guiding surfaces.
- G. Alternate guide shoes for Freight Elevator: Install on car frame four flexible sliding swivel guide shoes each assembled on a substantial metal base, to permit individual self-alignment to the guide rails.
 - 1. Provide each shoe with renewable non-metallic gibs of durable material having low coefficient of friction and long-wearing qualities, when operated on guide rails receiving infrequent, light applications of rail lubricant. Gibs containing graphite or other solid lubricants are not acceptable.

2. Flexible guide shoes of approved design, other than swivel type, may be used provided they are self-aligning on all three faces of the guide rails.
3. Provide spring take-up in car guide shoes for side play between rails.

2.30 GUIDE RAILS, SUPPORTS AND FASTENINGS

- A. Guide rails shall conform to ASME A17.1 Section 2.23.
- B. Guide rails for car shall be planed steel T-sections and weigh 22.5 kg/m (15 lb/ft). Guide rails for counterweight shall be planed steel T-sections and weigh 12.0 kg/m (8 lb/ft).
- C. Securely fasten guide rails to the brackets or other supports by heavy duty steel rail clips.
- D. Provide necessary car and counterweight rail brackets and counterweight spreader brackets of sufficient size and design to secure substantial rigidity to prevent spreading or distortion of rails under any condition.
 1. Slotted or oversized holes shall be fitted with flat washers and shall conform to ASME A17.1 Rule 2.23.10.3.
 2. Where fastenings are over 4.2 m (14 ft) apart, rails shall be reinforced with 228 mm (9 in.) channel or approved equal backing to secure the rigidity required.
- E. Rail joints and fishplates shall be in accordance with ASME A17.1 Rule 2.23.7. Rail joints shall not interfere with clamps and brackets. Design rail alignment shims to remain in place if fastenings become loose.
- F. Guide rails shall extend from channels on pit floor to within 76 mm (3 in.) of the underside of the concrete slab or grating at top of hoistway with a maximum deviation of 3.2 mm (1/8 in.) from plumb in all directions. Provide a minimum of 19 mm (3/4 in.) clearance between bottom of rails and top of pit channels.
- G. Guide rail anchorages in pit shall be made in a manner that will not reduce effectiveness of the pit waterproofing.
- H. In the event inserts or bond blocks are required for the attachment of guide rails, the Contractor shall furnish such inserts or bond blocks and shall install them in the forms before the concrete is poured. Use inserts or bond blocks only in concrete or block work where steel framing is not available for support of guide rails. Expansion-type bolting for guide rail brackets will not be permitted.

- I. Guide rails shall be clean and free of any signs of rust, grease, or abrasion before final inspection. Paint the shank and base of the T-section with two field coats of manufacturer's standard enamel.
- J. After completion of car safety testing during final inspection, all marks left on rails by application of car safety shall be filed smooth.

2.31 NORMAL AND FINAL TERMINAL STOPPING DEVICES

- A. Normal and final terminal stopping devices shall conform to ASME A17.1 Section 2.25.
- B. Mount terminal slowdown switches and direction limit switches on the elevator or in hoistway to reduce speed and bring car to an automatic stop at the terminal landings.
 - 1. Switches shall function with any load up to and including 125 percent of rated elevator capacity at any speed obtained in normal operation.
 - 2. Switches, when opened, shall permit operation of elevator in reverse direction of travel.
- C. Mount final terminal stopping switches in the hoistway.
 - 1. Switches shall be positively opened should the car travel beyond the terminal direction limit switches.
 - 2. Switches shall be independent of other stopping devices.
 - 3. Switches, when opened, shall remove power from hoist motor, apply hoist machine brake, and prevent operation of car in either direction.
- D. After final stopping switches have been adjusted, through bolt switches to guide rail.

2.32 CROSSHEAD DATA PLATE AND CODE DATA PLATE

- A. Permanently attach a non-corrosive metal Data Plate to car crosshead. Data plate shall bear information required by ASME A17.1 Section 2.16.3 and 2.20.2.1.
- B. Permanently attach a Code Data Plate, in plain view, to the controller, ASME A17.1 Section 8.9.

2.33 WORKMAN'S LIGHTS AND OUTLETS

- A. Provide duplex GFCI protected type receptacles and lamps with guards on top of each elevator car and beneath the platform. The receptacles shall be in accordance with Fed. Spec. W-C-596 for Type D7, 2-pole, 3-wire grounded type, rated for 15 amperes and 125 volts.

2.34 TOP-OF-THE CAR OPERATING DEVICE

- A. Provide a cartop operating device that meets the requirements of ASME A17.1 Section 2.26.
- B. The device shall be activated by a toggle switch mounted in the device. The switch shall be clearly marked "INSPECTION" and "NORMAL" on the faceplate, with 6 mm (1/4 in.) letters.
- C. Movement of the elevator shall be accomplished by the continuous pressure on a direction button and a safety button.
- D. Provide an emergency stop toggle type switch.
- E. Provide permanent identification for the operation of all components in the device.
- F. The device shall be permanently attached to the elevator crosshead on the side of the elevator nearest to the hoistway doors used for accessing the top of the car.

2.35 CAR LEVELING DEVICE

- A. Car shall be equipped with a two-way leveling device to automatically bring the car to within 3 mm (1/8 in.) of exact level with the landing for which a stop is initiated regardless of load in car or direction.
- B. If the car stops short or travels beyond the floor, the leveling device, within its zone shall automatically correct this condition and maintain the car within 3 mm (1/8 in.) of level with the floor landing regardless of the load carried.
- C. Provide encoded steel tape, steel tape with magnets or steel vanes with magnetic switches. Submit design for approval.

2.36 EMERGENCY STOP SWITCHES

- A. Provide an emergency stop switch for each top-of-car device, pit, machine spaces, service panel and firefighters' control panel inside the elevator. Mount stop switches in the pit adjacent to pit access door, at top of the pit ladder 1220 mm (48 in.) above the bottom landing sill and 1220 mm (48 in.) above the pit floor adjacent to the pit ladder.
- B. Each stop switch shall be red in color and shall have "STOP" and "RUN" positions legibly and indelibly identified.

2.37 MAIN CAR OPERATING PANEL

- A. Locate the main car operating panel in the car enclosure on the front return panel for passenger/service elevators and the front of the side wall for freight elevators. The top floor car call push button shall not be more than 1220 mm (48 in.) above the finished floor. Car call

push buttons and indicator lights shall be round with a minimum diameter of 25 mm (1 in.), LED white light illuminated. Coordinate to install on operating panel graphic level designators as indicated in drawings.

- B. One piece front faceplate, with edges beveled 15 degrees, shall have the firefighters' service panel recessed into the upper section and the service operation panel recessed into the lower section, fitted with hinged doors. Doors shall have concealed hinges, be in the same front plane as the faceplate and fitted with cylinder type key operated locks. Secure the faceplate with stainless steel tamperproof screws.
- C. All terminology on the main car operating panel shall be raised or engraved. Use 6 mm (1/4 in.) letters to identify all devices in upper section of the main car operating panel. The handicapped markings with contrasting background shall be recessed .030 inch in the faceplate, square or rectangular in shape, with the finished face of the 12 mm (1/2 in.) numerals and markings flush with the faceplates. Surface mounted plates are not acceptable.
- D. The upper section shall contain the following items in order listed from top to bottom:
 - 1. Engrave elevator number, 25 mm (1 in.) high with black paint for contrast.
 - 2. Engrave capacity plate information with black paint for contrast with freight loading class and number of passengers allowed.
 - 3. Emergency car lighting system consisting of a rechargeable battery, charger, controls, and LED illuminated light fixture. The system shall automatically provide emergency light in the car upon failure or interruption of the normal car lighting service, and function irrespective of the position of the light control switch in the car. The system shall be capable of maintaining a minimum illumination of 1.0 foot-candle when measured 1220 mm (48 in.) above the car floor and approximately 305 mm (12 in.) in front of the car operating panel, for not less than four (4) hours.
 - 4. LED illuminated digital car position indicator with direction arrows. Digital display floor numbers and direction arrows shall be a minimum of 50mm (2 in.) high.
 - 5. Firefighters' Emergency Operation Panel shall conform to the requirements of ASME A17.1 Section 2.27. Firefighters' Panel shall

- be 1676 mm (66 in.) minimum to 1830 mm (72 in.) maximum to the top of the panel above finished floor.
6. Firefighters' Emergency Indicator Light shall be round with a minimum diameter of 25 mm (1 in.).
 7. Medical Emergency switch marked "MEDICAL EMERGENCY" with two positions labeled "ON" and "OFF" and Medical Emergency Indicator Light located next to the key switch shall be round with a minimum diameter of 25 mm (1 in.). Instruction for Medical Emergency operation shall be engraved below the key switch and light.
 8. Key operated Independent Service; see Section 2.39 for detailed description.
 9. Provide a Door Hold button on the faceplate next to the independent service key switch. It shall have "DOOR HOLD" indelibly marked on the button. Button shall light when activated. When activated, the door shall stay open for a maximum of one minute. To override door hold timer, push a car call button or door close button. Door Hold button is not ADA required and Braille is not needed.
 10. Complete set of round car call push buttons, minimum diameter of 25 mm (1 in.), and LED white light illuminated, corresponding to the floors served. Car call buttons shall be legibly and indelibly identified by a floor number and/or letter not less than 12mm (1/2 in.) high in the face of the call button. Stack buttons in a single vertical column for low rise buildings up to six floors with front openings only.
 11. Door Open and Door Close buttons shall be located below the car call buttons. They shall have "OPEN" and "CLOSE" legibly and indelibly identified by letters in the face of the respective button. The Door Open button shall be located closest to the door jamb as required by ADA.
 12. Red Emergency Alarm button that shall be located below the car operating buttons. Mount the emergency alarm button not lower than 890 mm (35 in.) above the finished floor. It shall be connected to audible signaling devices as required by A17.1 Rule 2.27.1.2. Provide audible signaling devices including the necessary wiring.
 13. Emergency Help push button shall activate two way communications by Auto Dial telephone system as required by ASME A17.1 Rule 2.27.1.1.3. Help button shall be LED white light illuminated and flash when call is acknowledged. Legibly and indelibly label the

- button "HELP" in the face of the button with 12 mm (1/2 in.) high letters.
14. Provide a corresponding Braille plate on the left side of each button. The handicapped markings with contrasting background shall be recessed .030 inch in the faceplate, square or rectangular in shape, with the finished face of the 12 mm (1/2 in.) numerals and markings flush with the faceplates. Surface mounted plates are not acceptable.
- E. The service operation panel, in the lower section shall contain the following items:
1. Light switch labeled "LIGHTS" for controlling interior car lighting with its two positions marked "ON" and "OFF".
 2. Inspection switch that will disconnect normal operation and activate hoistway access switches at terminal landings. Switch shall be labeled "INSPECTION" with its two positions marked "ON" and "OFF".
 3. Three position switch labeled "FAN" with its positions marked "HIGH", "LOW" and "OFF" for controlling car ventilating blower.
 4. Two position, spring return, toggle switch or push button to test the emergency light and alarm device. It shall be labeled "TEST EMERGENCY LIGHT AND ALARM".
 5. Two position emergency stop switch, when operated, shall interrupt power supply and stop the elevator independently of regular operating devices. Emergency stop switch shall be marked "PULL TO STOP" and "PUSH TO RUN".

2.39 INDEPENDENT SERVICE

- A. Provide a legibly and indelibly labeled "INDEPENDENT SERVICE", two-position key operated switch on the face of the main car operating panel that shall have its positions marked "ON" and "OFF". When the switch is in the "ON" position, the car shall respond only to calls registered on its car dispatch buttons and shall bypass all calls registered on landing push buttons. The car shall start when a car call is registered, car call button or door close button is pressed, car and hoistway doors are closed, and interlock circuits are made. When switch is returned to "OFF" position, normal service shall be resumed.

2.40 CAR POSITION INDICATOR

- A. Provide an alpha-numeric digital car position indicator in the main car operating panel, consisting of numerals and arrows not less than 50 mm

(2 in.) high, to indicate position of car and direction of car travel.
Locate position indicator at the top of the main car operating panel,
illuminated by light emitting diodes.

2.41 AUDIO VOICE SYSTEM

A. Provide digitized audio voice system activated by stopping at a floor. Audio voice shall announce floor designations, direction of travel, and special announcements. The voice announcement system shall be a natural sounding human voice that receives messages and shall comply with ADA requirements for audible car position indicators. The voice announcer shall have two separate volume controls, one for the floor designations and direction of travel, and another for special announcements. The voice announcer shall have a full range loud speaker, located on top of the cab. The audio voice unit shall contain the number of ports necessary to accommodate the number of floors, direction messages, and special announcements. Install voice announcer per manufacturer's recommendations and instructions. The voice system shall be the product of a manufacturer of established reputation. Provide manufacturer literature and list of voice messages.

1. Fire Service Message
2. Medical Emergency Service Message
3. "Please do not block doors"
4. Provide special messages as directed by Contracting Officer Representative.

2.42 AUTO DIAL TELEPHONE SYSTEM

- A. Furnish and install a complete ADA compliant intercommunication system.
- B. Provide a two-way communication device in the car with automatic dialing, tracking and recall features with shielded wiring to car controller in machine room. Provide dialer with automatic rollover capability with minimum two numbers.
- C. "HELP" button shall illuminate and flash when call is acknowledged. Button shall match floor push button design.
- D. Provide "HELP" button tactile symbol engraved signage and Braille adjacent to button mounted integral with car operating panels.
- E. The auto dial system shall be located in the auxiliary car operating panel. The speaker and unit shall be mounted on the backside of the perforated stainless steel plate cover.
- F. Each elevator shall have individual phone numbers.

- G. If the operator ends the call, the phone shall be able to redial immediately.

2.43 CORRIDOR OPERATING DEVICE FACEPLATES

- A. Fabricate faceplates for elevator operating and signal devices from not less than 3 mm (1/8 in.) thick flat stainless steel with all edges beveled 15 degrees. Install all faceplates flush with surface on which they are mounted.
- B. Corridor push button faceplates shall be at least 127 mm (5 in.) wide by 305 mm (12 in.) high. The centerline of the landing push buttons shall be 1067 mm (42 in.) above the corridor floor.
- C. Elevator Corridor Call Station Pictograph shall be engraved in the faceplate.
- D. Fasten all car and corridor operating device and signal device faceplates with stainless steel tamperproof screws.
- E. Design corridor push button faceplates so that pressure on push buttons shall be independent of pressure on push button contacts.
- F. Engraved legends in faceplates shall have lettering 6 mm (1/4 in.) high filled with black paint.
- G. Provide a corresponding Braille plate on the left side of each button. The handicapped markings with contrasting background shall be recessed .030 inch in the faceplate, square or rectangular in shape, with the finished face of the 12 mm (1/2 in.) numerals and markings flush with the faceplates. Surface mounted plates are not acceptable.

2.44 CORRIDOR OPERATING DEVICES FOR PASSENGER/SERVICE ELEVATORS

- A. Provide one riser of landing call buttons.
- B. Fixtures for intermediate landings shall contain "UP" and "DOWN" buttons. Fixtures for terminal landings shall contain a single "UP" or "DOWN" button.
- C. Each button shall contain an integral registration LED white light which shall illuminate upon registration of a call and shall extinguish when that call is answered.
- D. The direction of each button shall be legibly and indelibly identified by arrows not less than 12 mm (1/2 in.) high in the face of each button.
- E. Landing push buttons shall not re-open the doors while the car and hoistway doors are closing at that floor, the call shall be registered for the next available elevator. Calls registered shall be canceled if

closing doors are re-opened by means of "DOOR OPEN" button or infrared curtain unit.

2.45 DIGITAL CORRIDOR LANTERN/POSITION INDICATOR

- A. Provide each car with combination corridor lantern/position indicator digital display mounted over the hoistway entrances at each and every floor. Provide each terminal landing with "UP" or "DOWN", minimum 64 mm (2 1/2 in.) high digital arrow lanterns and each intermediate landing with "UP" and "DOWN" digital arrow lanterns. Each lens shall be LED illuminated of proper intensity, so shielded to illuminate individual lens only. The lenses in each lantern shall be illuminated green to indicate "UP" travel and red to indicate "DOWN" travel. Lanterns shall signal in advance of car arrival at the landing indicating the direction of travel whether or not corridor button has been operated at that floor. Hall calls shall receive immediate assignment to individual cars and hall lantern shall sound and illuminate. Corridor lanterns shall not be illuminated when a car passes a floor without stopping. Each lantern shall be equipped with a clearly audible electronic chime which shall sound once for "UPWARD" bound car and twice for "DOWNWARD" bound car. Audible signal shall not sound when a car passes the floor without stopping. Provide adjustable sound level on audible signal. Car riding lanterns are not acceptable.
- B. Provide alpha-numeric digital position indicators directly over hoistway landing entranceways between the arrival lanterns at each and every floor. Indicator faceplate shall be stainless steel. Numerals shall be not less than 50 mm (2 in.) high with direction arrows. Cover plates shall be readily removable for re-lamping. The appropriate direction arrow shall be illuminated during entire travel of car in corresponding direction.
- C. Provide LED illumination in each compartment to indicate the position and direction the car is traveling by illuminating the proper alpha-numeric symbol. When the car is standing at a landing without direction established, arrows shall not be illuminated.

2.46 HOISTWAY ACCESS SWITCHES

- A. Provide hoistway access switches for elevator at top terminal landing to permit access to top of car, and at bottom terminal landing to permit access to pit. Elevators with side slide doors, mount the access key switch 1830 mm (6 ft) above the corridor floor in the wall next to the strike jamb. Elevators with center opening doors, mount the access

key switch 1830 mm (6 ft) above the corridor floor next to the hoistway entrance jamb. Exposed portion of each access switch or its faceplate shall have legible, indelible legends to indicate "UP", "DOWN", and "OFF" positions. Submit design and location of access switches for approval. Each access switch shall be a constant pressure cylinder type lock having not less than five pins or five stainless steel disc combination with key removable only when switch is in the "OFF" position. Lock shall not be operable by any other key which will operate any other lock or device used for any other purpose at the VA Medical Center. Arrange the hoistway switch to initiate and maintain movement of the car. When the elevator is operated in the down direction from the top terminal landing, limit the zone of travel to a distance not greater than the top of the car crosshead level with the top floor.

- B. Provide emergency access for all hoistway entrances, keyways for passenger and service elevators and locked door release system (key access) for freight elevators.

2.47 HOISTWAY ENTRANCES: PASSENGER/SERVICE ELEVATORS

- A. Provide entrances of metal construction using cold rolled steel. Door frames shall be constructed of stainless steel. Complete entrances with sills, hanger supports, hangers, tracks, angle struts, unit frames, door panels, fascia plates, toe guards, hardware, bumpers, sight guards, and wall anchors.
- B. Provide one piece extruded stainless steel sills with non-slip wearing surface, grooved for door guides and recessed for fascia plates. Sills shall have overall height of not less than 19 mm (3/4 in.), set true, straight, and level, with hoistway edges plumb over each other, and top surfaces flush with finished floor. Grout sills full length after installation.
- C. Construct hanger supports of not less than 4.5 mm (3/16 in.) thick steel plate, and bolted to strut angles.
- D. Structural steel angles 76 mm x 76 mm x 9 mm (3 in. x 3 in. x 3/8 in.) shall extend from top of sill to bottom of floor beam above, and shall be securely fastened at maximum 457 mm (18 in.) on center and at each end with two bolts.
- E. Provide jambs and head soffits, of not less than 14-gauge stainless steel, for entrances. Jambs and head soffits shall be bolted or welded construction, and provided with three anchors each side. Side jambs

shall be curved type. Radius of curvature shall be 89 mm (3 1/2 in.).

Head jamb shall be square type, and shall overhang corridor face of side jambs by 6 mm (1/4 in.). Rigidly fasten jambs and head soffits to building structure. Provide jambs with protective covering. After installation, protect jambs and head soffits with wood framing to prevent damage to finish during construction. Solidly grout jambs.

- F. Provide 14-gauge sheet steel fascia plates in hoistway to extend vertically from head of hanger support housing to sill above. Plates shall be the same width as the door opening of elevator and adequately reinforced to prevent waves and buckles. Below bottom terminal landing and over upper terminal landing provide shear guards beveled back to and fastened to the wall.
- G. Provide hoistway entrance with flush two speed side slide hoistway doors for Elevator P2 and center opening hoistway doors for Elevator P1. Door panels shall be not less than 16-gauge stainless steel, flush type construction, and not less than 32 mm (1 1/4 in.) thick. Wrap stainless steel around the leading and trailing edges of the door panel. Top and bottom of door panels shall have continuous stiffener channels welded in place. Reinforcement of the door panels shall be approximately 1.0 mm (0.04 in.) in thickness and of the hat section type. At bottom of each and every panel, provide two removable laminated phenolic gibs or other approved material guides and a separate fire gib. Reinforce each door panel for hangers, interlock mechanism, drive assembly, and closer. One door panel for each entrance shall bear a BOCA label, Underwriters' label, or in lieu of this, labels from other accredited test laboratories may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the COTR. Fasten sight guard of 14-gauge stainless steel, extending full height of panel, to leading edge of fast speed panel of two-speed doors or each panel of center opening doors.
- H. Provide hangers for hoistway door panels and provide relating devices to transmit motion from one door panel to the other. Fasten the hangers to the door sections. Provide reinforcements at the point of attachment. The hanger shall have provisions for vertical and lateral adjustments. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with rubber or non-metallic sound-reducing tires mounted on a malleable iron

or steel bracket. The hanger sheaves shall operate at a relatively low rotational speed, and shall roll on a high-carbon, cold-rolled or drawn steel track shaped to permit free movement of sheaves without regard to vertical adjustment of sheave, bracket or housing. Beneath the track and each hanger sheave, provide a hardened steel up-thrust roller capable of withstanding a vertical thrust equal to the carrying capacity of adjacent upper sheave. The up-thrust shall have fine vertical adjustments, and the face of the roller shaped so as to permit free movement of the hanger sheave. The up-thrust roller shall have ball or roller bearings. Provide the hanger sheaves with steel fire stops to prevent disengagement from tracks.

- I. Do not use hangers that are constructed integrally with the door panels.
- J. Provide raised numerals on cast, rear mounted plates for all openings. Numerals shall be a minimum of 50 mm (2 in.) high, located on each side of entrance frame, with centerline of 1524 mm (5 ft) above the landing sill. The number plates shall contain Braille.
- K. Provide unique car number on every elevator entrance at designated main fire service floor level, minimum 76 mm (3 in.) in height.

2.48 ELECTRIC INTERLOCKS

- A. Equip each hoistway door with an interlock, functioning as hoistway unit system, to prevent operation of car until all hoistway doors are locked in closed position. Hoistway door interlocks shall not be accepted unless they meet the requirements of ASME A17.1 Section 2.12.
- B. Equip car doors with electric contact that prevents operation of car until doors are closed unless car is operating in leveling zone or hoistway access switch is used. Locate door contact to prevent its being tampered with from inside of car. Car door contact shall not be accepted unless it meets the requirements of ASME A17.1 Section 2.12.
- C. Wiring installed from the hoistway riser to each door interlock shall be NEC type SF-2 or equivalent.
 - 1. Type SF-2 cable terminations in the interlock housing shall be sleeved with glass braid fillers or equivalent.
- D. Provide devices, either mechanical or electrical, that shall prevent operation of the elevator in event of damaged or defective door equipment that has permitted an independent car or hoistway door panel to remain in the "unclosed" and "unlocked" position.

2.49 CAR FRAME: PASSENGER/SERVICE ELEVATORS

- A. Car frame shall conform to the requirements of ASME A17.1 Section 2.15, constructed of steel plates and structural shapes securely riveted, bolted, or welded together. Iron casting shall not be permitted. The entire assembly shall be rugged construction, and amply braced to withstand unequal loading of platform. Car frame members shall be constructed to relieve the car enclosure of all strains. Balance car front to back and side to side. Provide balancing weights and frames, properly located, to achieve the required true balance.

2.50 CAR PLATFORM: PASSENGER/SERVICE ELEVATORS

- A. Construct the car platform to comply with all the requirements of ASME A17.1 Section 2.15.5. The platform shall be designed to withstand the forces developed under the loading conditions specified. Provide car entrances with extruded aluminum sill or better with machined or extruded guide grooves. Cover underside and all exposed edges of wood filled platform with sheet metal of not less than 27-gauge, with all exposed joints and edges folded under. Fire resistant paint is not acceptable. Platform shall have flexible composition flooring not less than 3 mm (1/8 in.) thick. For color, see Section 09 06 00, SCHEDULE FOR FINISHES. Adhesive material shall be type recommended by manufacturer of flooring. Lay flooring flush with threshold plate and base.
- B. Provide a platform guard (toe guard) that meets the requirements of ASME A17.1 Section 2.15.9, of not less than 12-gauge sheet-steel on the entrance side, extend 76 mm (3 in.) beyond each side of entrance jamb. Securely brace platform guard to car platform, and bevel bottom edge at a 60-75 degree angle from horizontal. Install platform in the hoistway, so that the clearance between front edge and landing threshold shall not exceed 32 mm (1 1/4 in.).
- C. Isolate the platform from the car frame by approved rubber pads or other equally effective means.
- D. Provide adjustable diagonal brace rods to hold platform firmly within car suspension frame.
- E. Provide a bonding wire between frame and platform.

2.51 CAR ENCLOSURE: PASSENGER/SERVICE ELEVATORS

- A. Car enclosure shall have a dome height inside the cab of 2440 mm (8 ft).

- B. Securely fasten car enclosure to platform by through bolts located at intervals of not more than 457 mm (18 in.) running through an angle at the base of panels to underside of platform. Provide 6 mm (1/4 in.) bolts with nuts and lock washers.
- C. Car enclosure base shall be of 14-gauge stainless steel, 152 mm (6 in.) high. Provide straight type base at front return sides. Vertical face of base at sides and rear shall be flush with or recessed behind the wainscot directly above the base. There shall be no exposed fastenings in base. Provide natural ventilation openings divided equally between the bottom and top of the car enclosure that shall provide a minimum 3.5 percent of the inside car floor area.
- D. Construct canopy of not less than 12-gauge steel.
- E. Car top railings that meet the requirement of ASME A17.1 Rules 2.14.1.7 and 2.10.2.
- F. Front return wall panel, entrance columns, rear corner columns, entrance head-jamb and transom shall be 14-gauge stainless steel full height of car. Side and rear walls from top of base to top of panel shall be constructed of 14-gauge cold rolled steel. Side and rear walls up to 1220 mm (48 in.) above finished floor shall be covered with stainless steel. Side and rear walls from 1220 (48 in.) to the ceiling shall be covered with high gloss white acrylic wall panels set in stainless steel reveals as indicated in drawings. . Apply directly to the cab walls or to 13 mm (1/2 in.) plywood/particle board that meets requirements of ASTM E 84, UL 723, and CAN/ULC-S102.2, whichever is applicable. Submit a method of fastening plywood/particle board to steel walls. It shall be flush with the face of the bottom section of the stainless steel. Plastic laminate shall comply with Federal Specification L-P-508, Style Type 1, and Class 1. Color is specified in Section 09 06 00, SCHEDULE FOR FINISHES, Interior shall be flush panel construction with angles welded on exterior to ensure adequate rigidity. Coat exterior of panels with mastic sound insulation material approximately 2.5 mm (3/32 in.) thick followed by a prime coat of paint. Mastic material shall conform to ASTM E1042.
- 1. Smooth and flush all joints with no ragged or broken edges. Plastic laminate shall comply with NEMA LD-3, textured finish, general purpose type, grade designation GP 50, and 0.050 in. thickness, except with a minimum wear resistance of 1200 cycles, and backer sheet, grade designation BK 20, and 0.020 in. thickness.

- G. Provide a hinged top emergency exit cover. Exit shall be unobstructed when open and shall have mechanical stops on the cover. Provide a code approved exit switch to prevent operation of the elevator when the emergency exit is open.
- H. Provide duplex, GFCI protected type receptacle in car. Locate flush-mounted receptacle on the centerline of the main car operating panel, 150 mm (6 in.) above the car floor.
- I. Lighting for passenger elevators:
 - 1. Provide aluminum hanging ceiling frame. Construct frame of 1/8 in. x 1 1/2 in. x 1 1/2 in. "T" and "L" sections, divide ceiling into six panels.
 - 2. Provide fluorescent or LED illuminated car light fixtures above the ceiling panels. See Specification 265100, Interior Lighting for fixture and ballast type. Maintain a minimum light level of 50-foot candles at 914 mm (36 in.) above the finished floor.
- J. Provide a blower unit arranged to exhaust through an opening in the canopy. Provide a stainless or chrome plated fan grill around the opening. Provide 2-speed fan, capable of rated free delivery air displacement of approximately 380 and 700 cfm at respective speeds. Mount fan on top of car with rubber isolation to prevent transmission of vibration to car structure. Provide screening over intake and exhaust end of blower. Provide a 3-position switch to control the unit in the service panel.
- K. Provide car enclosure with two sets of stainless steel handrails.
 - 1. 75 mm (3 in.) wide x 9 mm (3/8 in.) thick flatstock located with centerlines 750 mm and 1050 mm (30 in. and 42 in.) above the car floor.
 - 2. Locate handrails 38 mm (1 1/2 in.) from cab wall. Install handrails on two sides. Curve ends of handrails to walls. Conceal all handrail fastenings. Handrails shall be removable from inside the car enclosure.
- L. Provide car entrance with side opening and center opening horizontal sliding car doors, of same type as hoistway doors for Elevators P1 and P2. Construct door panels to be flush hollow metal construction, not less than 32 mm (1 1/4 in.) thick, consisting of one continuous piece 16-gauge stainless steel on car side face wrapped around the leading and trailing edges. Separate two plates by a sound-deadening material, and reinforce by steel shapes welded to the plates at frequent

intervals. Reinforce panels as required for installation of hangers, power-operating and door-opening devices. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with rubber or non-metallic sound-reducing tires. Equip hangers with adjustable ball-bearing rollers to take upward thrust of panels. Upthrust rollers shall be capable of being locked in position after adjustment to a maximum of .38 mm (1/64 in.) clearance. Provide two laminated phenolic gibs on each door panel. Gibs shall be replaceable without removal of door panel. Provide door drive assembly, restrictor, gate switch, header, track, arms, and all related door hardware.

2.52 POWER DOOR OPERATORS: PASSENGER/SERVICE ELEVATORS

- A. Provide a high-speed heavy duty door operator to automatically open the car and hoistway doors simultaneously when the car is level with the floor, and automatically close the doors simultaneously at the expiration of the door-open time. Provide solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current. Motor shall be of the high-internal resistance type, capable of withstanding high currents resulting from stall without damage to the motor. The door operator shall be capable of opening a car door and hoistway door simultaneously, at a speed of .762 m (2.5 ft) per second. The closing speed of the doors shall be .3 m (1 ft) per second. A reversal of direction of the doors from the closing to opening operation, whether initiated by obstruction of the infrared curtain or the door "OPEN" button, shall be accomplished within 38 mm (1.5 in.) maximum of door movement. Emphasis is placed on obtaining quiet interlock and door operation; smooth, fast, dynamic braking for door reversals, stopping of the door reversal, and stopping of the doors at extremes of travel. Construct all levers and drive arms operating the doors, of heavy steel members, and all pivot points shall have ball or roller bearings. Auxiliary automatic door closers required under ASME A17.1 Section 2.11.3 shall be spring loaded sill mounted type.
- B. Hoistway doors and car gates shall be manually operable in an emergency without disconnecting the power door operating equipment unless the car is outside the unlocking zone.
1. It shall not be possible for the doors to open by power unless the elevator is within the leveling zone.

2. Provide infrared curtain unit. The device shall cause the car and hoistway doors to reverse automatically to the fully-open position should the unit be actuated while the doors are closing. Unit shall function at all times when the doors are not closed, irrespective of all other operating features. The leading edge of the unit shall have an approved black finish.
- C. Should the doors be prevented from closing for more than a predetermined adjustable interval of 20 to 60 seconds by operation of the curtain unit, the doors shall stay open, the audio voice message and a buzzer located on the car shall sound only on automatic operation. **Do not provide door nudging.**
1. If an obstruction of the doors should not activate the photo-electric door control device and prevent the doors from closing for more than a predetermined adjustable interval of 15 to 30 seconds, the doors shall reverse to the fully open position and remain open until the "Door Close" button re-establishes the closing cycle.
- D. Provide door "OPEN" and "CLOSE" buttons. When the door "OPEN" button is pressed and held, the doors, if in the open position, shall remain open and if the doors are closing, they shall stop, reverse and re-open. Momentary pressure of the door "CLOSE" button shall initiate the closing of the doors prior to the expiration of the normal door open time.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine work of other trades on which the work of this Section depends. Report defects to the Contracting Officer Representative in writing that may affect the work of this trade or equipment operation dimensions from site for preparation of shop drawings.
- B. Ensure that shafts and openings for moving equipment are plumb, level and in line, and that pit is to proper depth, waterproofed and drained with necessary access doors, ladder and guard.
- C. Ensure that machine room is properly illuminated, heated and ventilated, and equipment, foundations, beams correctly located complete with floor and access stairs and door.
- D. Before fabrication, take necessary job site measurements, and verify where work is governed by other trades. Check measurement of space for

equipment, and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.

- E. Ensure the following preparatory work, provided under other sections of the specification has been provided. If the Elevator Contractor requires changes in size or location of trolley beams or their supports and trap doors, etc., to accomplish their work, he must make arrangements, subject to approval of the Contracting officer, and include additional cost in their bid. Where applicable, locate controller near and visible to its respective hoisting machinery. Work required prior to the completion of the elevator installation:
1. Supply of electric feeder wires to the terminals of the elevator control panel, including circuit breaker.
 2. Provide light and GFCI outlets in the elevator pit and machine room.
 3. Furnish electric power for testing and adjusting elevator equipment.
 4. Furnish circuit breaker panel in machine room for car and hoistway lights and receptacles.
 5. Supply power for cab lighting and ventilation from an emergency power panel specified in Division 26, ELECTRICAL.
 6. Machine room enclosed and protected from moisture, with self closing, self locking door and access stairs.
 7. Provide fire extinguisher in machine room.
- F. Supply for installation, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

3.2 SPACE CONDITIONS

- A. Attention is called to overhead clearance, pit clearances, overall space in machine room, and construction conditions at building site in connection with elevator work. Addition or revision of space requirements, or construction changes that may be required for the complete installation of the elevators must be arranged for and obtained by the Contractor, subject to approval by Contracting Officer Representative. Include cost of changes in bid that become a part of the contract. Provide proper, code legal installation of equipment, including all construction, accessories and devices in connecting with elevator, mechanical and electrical work specified.
- B. Where concrete beams, floor slabs, or other building construction protrude more than 50 mm (2 in.) into hoistway, bevel all top surfaces of projections to an angle of at 75 degrees with the horizontal.

3.3 INSTALLATION

- A. Perform work with competent Certified Elevator Mechanics and Apprentices skilled in this work and under the direct supervision of the Elevator Contractor's experienced foreman.
- B. Set hoistway entrances in alignment with car openings, and true with plumb sill lines.
- C. Erect hoistway sills, headers and frames prior to erection of rough walls and doors. Erect fascias and toe guards after rough walls are finished.
- D. Install machinery, guides, controls, car and all equipment and accessories in accordance with manufacturer's instructions, applicable codes and standards.
- E. Isolate and dampen machine vibration with properly sized sound-reducing anti-vibration pads.
- F. Grout sills and hoistway entrance frames.

3.4 ARRANGEMENT OF EQUIPMENT

- A. Clearance around elevator, mechanical and electrical equipment shall comply with applicable provisions of NEC. Arrange equipment in machine room so that major equipment components can be removed for repair or replacement without dismantling or removing other equipment in the same machine room. Locate controller near and visible to its respective hoisting machine.

3.5 WORKMANSHIP AND PROTECTION

- A. Installations shall be performed by Certified Elevator Mechanics and Apprentices to best possible industry standards. Details of the installation shall be mechanically and electrically correct. Materials and equipment shall be new and without imperfections.
- B. Recesses, cutouts, slots, holes, patching, grouting, refinishing to accommodate installation of equipment shall be included in the Contractor's work. All new holes in concrete shall be core drilled.
- C. Structural members shall not be cut or altered. Work in place that is damaged or defaced shall be restored equal to original new condition.
- D. Finished work shall be straight, plumb, level, and square with smooth surfaces and lines. All machinery and equipment shall be protected against dirt, water, or mechanical injury. At final completion, all work shall be thoroughly cleaned and delivered in perfect unblemished condition.

- E. Beams, slabs, or other building construction protruding more than four inches into the hoistway, all top surfaces shall be beveled at an angle of at least 75 degrees to the horizontal.
- F. Sleeves for conduit and other small holes shall project 50 mm (2 in.) above concrete slabs.
- G. Hoist cables that are exposed to accidental contact in the machine room and pit shall be completely enclosed with 16-gauge sheet metal or expanded metal or guards.
- H. Exposed gears, sprockets, and sheaves shall be guarded from accidental contact in accordance with ASME A17.1 Section 2.10.

3.6 CLEANING

- A. Clean machine room and equipment.
- B. Perform hoistway clean down.
- C. Prior to final acceptance; remove protective coverings from finished or ornamental surfaces. Clean and polish surfaces with regard to type of material.

3.7 PAINTING AND FINISHING

- A. Hoist machine, motor, shall be factory painted with manufacturer's standard finish and color.
- B. Controller, sheave, car frame and platform, counterweight, beams, rails and buffers, except their machined surfaces, cams, brackets and all other uncoated ferrous metal items shall be painted one factory priming coat or approved equal.
- C. Upon completion of installation and prior to final inspection, all equipment shall be thoroughly cleaned of grease, oil, cement, plaster and other debris. All equipment, except that otherwise specified as to architectural finish, shall then be given two coats of paint of approved color, conforming to manufacturer's standard.
- D. Field painting of governors shall be in accordance with ASME A17.1 Rule 2.18.3.1.
- E. Stencil or apply decal floor designations not less than 100 mm (4 in.) high on hoistway doors, fascias or walls within door restrictor areas as required by ASME A17.1 Rule 2.29.2. The color of paint used shall contrast with the color of the surfaces to which it is applied.
- F. Elevator hoisting machine, controller, governor, main line shunt trip circuit breaker, safety plank, and cross head of car shall be identified by 100 mm (4 in.) high numerals and letters located as

directed. Numerals shall contrast with surrounding color and shall be stenciled or decaled.

G. Hoistway Entrances of Passenger, and Service Elevators:

1. Door panels shall be parkerized or given equivalent rust resistant treatment and a factory finish of one coat of baked-on primer and one factory finish coat of baked-on enamel.
2. Fascia plates, top and bottom shear guards, dust covers, hanger covers, and other metalwork, including built-in or hidden work and structural metal, (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given one approved prime coat in the shop, and one field coat of paint of approved color.

H. Hoistway Entrances of Freight Elevators:

1. Metal surfaces of doors and frames shall receive shop prime coat.
2. Finish painting, after installation, shall be one coat of paint of approved color. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.

I. Elevator Cabs for Passenger and Service Elevators:

1. Interior and exterior steel surfaces shall be parkerized or given equivalent rust resistant treatment before finish is applied.
2. Interior steel surfaces shall be factory finished with one coat of baked on enamel or proxylin lacquer. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.
3. Give exterior faces of car doors one finish coat of paint of medium gray color.

J. Elevator Cabs for Freight Elevators:

1. Give interior of cab one prime coat and a minimum of one coat of enamel. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.
2. Give exterior of cab one prime coat and one finish coat of an approved paint.
3. All surfaces of door frames, door panels, and cab interior surfaces that become damaged or marred shall be restored to original condition before final acceptance of work.

3.8 PRE-TESTS AND TESTS

- A. Pre-test the elevators and related equipment in the presence of the Contracting Officer Representative or his authorized representative for proper operation before requesting final inspection. Conduct final

inspection at other than normal working hours, if required by Contracting Officer Representative.

1. Procedure outlined in the Inspectors Manual for Electric Elevators, ASME A17.2 shall apply.
 - a. Final test shall be conducted in the presence of and witnessed by an ASME QEI-1 Certified Elevator Inspector.
 - b. Government shall furnish electric power including necessary current for starting, testing, and operating machinery of each elevator.
2. Contractor shall furnish the following test instruments and materials on-site and at the designated time of inspection: properly marked test weights, voltmeter, amp probe, thermometers, direct reading tachometer, megohm meter, vibration meter, sound meter, light meter, stop watch, and a means of two-way communication.
- B. Inspect workmanship, equipment furnished, and installation for compliance with specification.
- C. Balance Tests: The percent of counterbalance shall be checked by placing test weights in car until the car and counterweight are equal in weight when located at the mid-point of travel. If the actual percent of counter balance does not conform to the specification, the amount of counterweight shall be adjusted until conformance is reached.
- D. Full-Load Run Test: Elevators shall be tested for a period of one hour continuous run with full contract load in the car. The test run shall consist of the elevator stopping at all floors, in either direction of travel, for not less than five or more than ten seconds per floor.
- E. Speed Test: The actual speed of the elevator shall be determined in both directions of travel with full contract load, balanced load and no load in the elevator. Speed shall be determined by applying a certified tachometer to the car hoisting ropes or governor rope. The actual measured speed of the elevator with all loads in either direction shall be within three (3) percent of specified rated speed. Full speed runs shall be quiet and free from vibration and sway.
- F. Temperature Rise Test: The temperature rise of the hoisting motor shall be determined during the full load test run. Temperatures shall be measured by the use of thermometers. Under these conditions, the temperature rise of the equipment shall not exceed 50 degrees Centigrade above ambient temperature. Test shall start when all machine room equipment is within five (5) degrees Centigrade of the ambient

temperature. Other tests for heat runs on motors shall be performed as prescribed by the Institute of Electrical and Electronic Engineers.

- G. Car Leveling Test: Elevator car leveling devices shall be tested for accuracy of leveling at all floors with no load in car, balanced load in car, and with contract load in car, in both directions of travel. Accuracy of floor level shall be within plus or minus 3 mm (1/8 in.) of level with any landing floor for which the stop has been initiated regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel and shall maintain the car floor within plus or minus 3 mm (1/8 in.) of level with the landing floor regardless of change in load.
- H. Brake Test: The action of the brake shall be prompt and a smooth stop shall result in the up and down directions of travel with no load and rated load in the elevator. Down stopping shall be tested with 125 percent of rated load in the elevator.
- I. Insulation Resistance Test: The elevator's complete wiring system shall be free from short circuits and ground faults and the insulation resistance of the system shall be determined by use of megohm meter, at the discretion of the Elevator Inspector conducting the test.
- J. Safety Devices and Governor Tests: The safety devices and governor shall be tested as required by ASME A17.1 Section 8.10.
- K. Overload Devices: Test all overload current protection devices in the system at final inspection.
- L. Limit Stops:
1. The position of the car when stopped by each of the normal limit stops with no load and with contract load in the car shall be accurately measured.
 2. Final position of the elevator relative to the terminal landings shall be determined when the elevator has been stopped by the final limits. The lower limit stop shall be made with contract load in the elevator. Elevator shall be operated at inspection speed for both tests. Normal limit stopping devices shall be inoperative for the tests.
- M. Oil Buffer Tests: These tests shall be conducted with operating device and limit stops inoperative and with contract load in the elevator for the car buffer and with no load in the elevator for the counterweight buffer. Preliminary test shall be made at the lowest (leveling) speed.

Final tests shall be conducted at contract speed. Buffers shall compress and return to the fully extended position without oil leakage.

- N. Setting of Car Door Contacts: The position of the car door at which the elevator may be started shall be measured. The distance from full closure shall not exceed that required by ASME A17.1. The test shall be made with the hoistway doors closed or the hoistway door contact inoperative.
- O. Setting of Interlocks: The position of the hoistway door at which the elevator may be started shall be measured and shall not exceed ASME A17.1 requirements.
- P. Operating and Signal System: The elevator shall be operated by the operating devices provided and the operation signals and automatic floor leveling shall function in accordance with requirements specified. Starting, stopping and leveling shall be smooth and comfortable without appreciable steps of acceleration or deceleration.
- Q. Performance of the Elevator supervisory system shall be witnessed and approved by the representative of the Contracting Officer Representative.
- R. Evidence of malfunction in any tested system or parts of equipment that occurs during the testing shall be corrected, repaired, or replaced at no additional cost to the Government, and the test repeated.
- S. If equipment fails test requirements and a re-inspection is required, the Contractor shall be responsible for the cost of re-inspection; salaries, transportation expenses, and per-diem expenses incurred by the representative of the Contracting Officer Representative.

3.9 INSTRUCTION OF VA PERSONNEL

- A. Provide competent instruction to VA personnel regarding the operation of equipment and accessories installed under this contract, for a period equal to one eight hour day. Instruction shall commence after completion of all work and at the time and place directed by the Contracting Officer Representative.
- B. Written instructions in triplicate relative to care, adjustments and operation of all equipment and accessories shall be furnished and delivered to the Contracting Officer Representative in independently bound folders. DVD recordings will also be acceptable. Written instructions shall include correct and legible wiring diagrams, nomenclature sheet of all electrical apparatus including location of each device, complete and comprehensive sequence of operation, complete

replacement parts list with descriptive literature, and identification and diagrammatic cuts of equipment and parts. Information shall also include electrical operation characteristics of all circuits, relays, timers, and electronic devices, as well as R.P.M. values and related characteristics for all rotating equipment.

- C. Provide supplementary instruction for any new equipment that may become necessary because of changes, modifications or replacement of equipment or operation under requirements of paragraph entitled "Warranty of Construction".

3.10 INSPECTIONS AND SERVICE: GUARANTEE PERIOD OF SERVICE

- A. Furnish complete inspection and maintenance service on entire elevator installation for a period of one (1) year after completion and acceptance of all the elevators in this specification by the Contracting Officer Representative. This maintenance service shall run concurrently with the warranty. Maintenance work shall be performed by Certified Elevator Mechanics and Apprentices employed and supervised by the company that is providing guaranteed period of service on the elevator equipment specified herein.
- B. This contract will cover full maintenance including emergency call back service, inspections, and servicing the elevators listed in the schedule of elevators. The Elevator Contractor shall perform the following:
1. Bi-weekly systematic examination of equipment.
 2. During each maintenance visit the Elevator Contractor shall clean, lubricate, adjust, repair and replace all parts as necessary to keep the equipment in first class condition and proper working order.
 3. Furnishing all lubricant, cleaning materials, parts and tools necessary to perform the work required. Lubricants shall be only those products recommended by the manufacturer of the equipment.
 4. Equalizing tension, shorten or renew hoisting ropes where necessary to maintain the safety factor.
 5. As required, motors, controllers, selectors, leveling devices, operating devices, switches on cars and in hoistways, hoistway doors and car doors or gate operating device, interlock contacts, guide shoes, guide rails, car door sills, hangers for doors, car doors or gates, signal system, car safety device, governors, tension and sheaves in pit shall be cleaned, lubricated and adjusted.

6. Guide rails, overhead sheaves and beams, counterweight frames, and bottom of platforms shall be cleaned every three months. Car tops and machine room floors shall be cleaned monthly. Accumulated rubbish shall be removed from the pits monthly. A general cleaning of the entire installation including all machine room equipment and hoistway equipment shall be accomplished quarterly. Cleaning supplies and vacuum cleaner shall be furnished by the Contractor.
 7. Maintain the performance standards set forth in this specification.
 8. The operational system shall be maintained to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.
 9. Maintain smooth starting and stopping and accurate leveling at all times.
- C. Maintenance service shall not include the performance of work required as a result of improper use, accidents, and negligence for which the Elevator Contractor is not directly responsible.
- D. Provide 24 hour emergency call-back service that shall consist of promptly responding to calls within two hours for emergency service should a shutdown or emergency develop between regular examinations. Overtime emergency call-back service shall be limited to minor adjustments and repairs required to protect the immediate safety of the equipment and persons in and about the elevator.
- E. Service and emergency personnel shall report to the Contracting Officer Representative or his authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed shall be given to the Contracting Officer Representative or his authorized representative.
- F. The Elevator Contractor shall maintain a log book in the machine room. The log shall list the date and time of all weekly examinations and all trouble calls. Each trouble call shall be fully described including the nature of the call, necessary correction performed or parts replaced.
- G. Written "Maintenance Control Program" shall be in place to maintain the equipment in compliance with ASME A17.1 Section 8.6.

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