HDR Architecture, Inc.

San Francisco VA Medical Center

San Francisco, CA

VMU Replacement and Expansion Project
Contract Documents (CD3 - 100%)
Client Project Number: 662-10-608

Construction Documents
Project Manual

VOLUME 01

January 7, 2013

HDR Project No. 143738

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SUBSURFACE DRILLING AND SAMPLING INFORMATION

PART 1 - GENERAL

1.1 SOILS REPORT

A. Soils Report (a.k.a. Geotechnical Investigation Report), environmental assessment report, environmental evaluation report & soil/rock profiling report has been prepared for Owner. Report was prepared to assist in design process. Copies are available upon request.

B. No representation or warranty is made by Architect, Engineer, Owner or any other party regarding completeness, accuracy, adequacy, or contents of report or of the subsurface investigation upon which report is based.

1.2 AVAILABILITY

A. Copies of report may be obtained from Owner upon request.
   1. Office of Owner
      SFVAMC – COTR
      4150 Clement Street
      San Francisco, CA. 94121
      Attention: Jon Bassignani

1.3 BIDDER RESPONSIBILITY

A. Bidders accept full responsibility for using soil information in preparing bids.

B. Bidder is responsible to obtain, at its expense, any additional information necessary to bid and perform Work.

C. Bidders agree they will make no claim, exceeding actual cost of work, if, in performing the Work, they find actual subsurface conditions encountered do not conform to those indicated by soil borings, test excavations, and other subsurface investigations.

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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 as required by drawings and specifications.

Scope: Contractor shall construct the VMU Replacement and Expansion Project and perform all work as required by attachments, drawings, and specifications. The new construction project will involve architectural, civil, mechanical, underground utilities, electrical, plumbing, fire protection, landscape, and structural work. Complete all work described in the construction documents and specifications. This building is being constructed for the Veterinary Medical Unit Research. Work that would impede critical hospital operations shall be done outside of normal business hours; such work includes utility shutdowns and hospital pathways must be maintained for ADA accessibility and ambulatory access during construction at all times. The majority of work for this project shall be done between 7am and 4:30pm Monday through Friday. Any work outside of those hours must be approved by the COTR. Complete all work in no more than 500 Days after Notice to proceed. Contractor shall include all listed attachments as part of the scope of work:

Attachment 1: Bidder Price Breakdown

Attachment 2: Wage Determination 11-16-2013

Attachment 3: SFVAMC Vivarium Project Manual Vol 1 20130107

Attachment 4: SFVAMC Vivarium Project Manual Vol 2 20130107

Attachment 5: Deduct List Document Set – 20130107

a. Deduct List Document Set Index & Deduct Lists

b. Deduct List Drawing Set

Attachment 6: 20110314 100 Drawing Set Signed Rev 1 20130107

Attachment 7: 20100920_Asbestos & Lead Survey_Final_T17.pdf

Attachment 8: 20100921_Environmental Evaluation_Final.pdf

Attachment 9: 20100922_Geotech Report_Final.pdf

Attachment 10: Soil Rock profiling Report 5_6_2011.pdf

Attachment 11: SFVAMC VMU Fonsi and Final EA

a) Project shall be phased to allow the construction of the new pedestrian pathway to be completed first. The VMU building construction shall begin after the pathway is built. The contractor shall maintain pedestrian and ADA accessibility access from parking lot J to parking lot E. This path shall be maintained at all times during construction. Contractor will insure a wooden protective barrier for this path to be maintained for the duration of the project. The contractor shall keep the path free of debris and cleaned daily as needed.

b) ARCHAEOLOGICAL MONITORING FOR THE VMU EXCAVATION

b.1 Introduction to Archaeological Monitoring

1. Contractor shall provide for the San Francisco VA Medical Center (SFVAMC), located in San Francisco, CA, all In Accordance With (IAW) this SOW and contract terms and conditions.
2. The contractor shall provide all necessary/required investigative work, tools, equipment, materials, labor, travel, expertise, analysis, etc., to accomplish the scope and requirements outlined in this SOW, for **Project No. 662-608, "Veterinary Medical Unit (VMU) Replacement and Expansion"**
3. Submit final Report on DVD/CD ROM. The contractor is responsible for producing all documents (i.e.: reports, etc.), in accordance with professional standard practices and VA criteria.
4. The following resources will be available from the COTR at SFVAMC as needed.

b.2 GENERAL ARCHAEOLOGICAL MONITORING SCOPE:

The contractor shall provide an Archaeological Monitoring service during the excavation of the Veterinary Medical Unit (VMU) Replacement and Expansion project. The contractor shall ensure that a qualified archaeologist is present during all ground disturbing activities associated with the project. This monitoring service shall be for undiscovered subsurface cultural materials.

b.3 DELIVERABLES:

1. INVESTIGATIVE/CLASSIFICATION SERVICES:

a. Provide onsite Archaeological Monitoring by a qualified Archeologist for the possibility of the unanticipated discovery of subsurface cultural materials during ground disturbing activities associated with the project.

b. Provide an Archeological Monitoring plan that meets all State Historic Preservation Office requirements and is completed by a qualified Archeologist.

c. Preparation of a Letter Report with recommendations if any artifacts are identified. Provide a detailed professional report with log in and out times of daily activities of excavation. Provide all observations on a day to day format with summary for the State Historic Preservation Office. Include all proper documentation for being a qualified Archeologist within the report. Report shall be given to the COTR (2) weeks after the final ground breaking activities.

B. Visits to the site by Bidders may be made only by appointment with the Medical Center Contracting Officer.

C. Offices of HDR Architecture Inc., 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.

D. Before placement and installation of work subject to tests by testing laboratory retained by the contractor, the Contractor shall notify the COTR Engineer in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three working days unless otherwise designated by the COTR Engineer.

E. All employees of general contractor and subcontractors shall comply with VA's security program and obtain a VA ID badge from VA police. See paragraph 1.35 below for ID badge process. Along with ID

Badges all workers must be able to speak and understand English during construction. Construction areas as defined by the contract documents will be keyed to a construction core when Notice to Proceed is issued. Access to non-construction areas is limited to public areas only. Access needed outside of construction area (i.e., mechanical rooms) will be provided by COTR or his/her representative upon written or verbal request.

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

G. Training:

1. Beginning July 31, 2005, all employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team.

2. In addition to the 10-hours OSHA training, VA will provide site- specific training as determined by VA Competent Person with input from the VA's Infection Control Risk Assessment team. Coordination of this required training will be accomplished through the COTR or Project Engineer. 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. All contractors, subcontractors, and vendors must receive this training in order to work at our facility. Failure to receive this training may cause debarment of contractor's staff until such training is accomplished.

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

1.2 STATEMENT OF BID ITEM(S)

A.

ITEM #1 - Base Bid: the Base Bid shall include all labor and material required to construct VMU Replacement and Expansion Project at the designated site including all the requirements in this Statement of Work, all attachments, drawings, and specifications.

ITEM #2 - Deduct 1:

a. Deduct all work associated with both canopies of the front and receiving doors;

b. Deduct scope for the demolition of existing Building 17;

c. Defer CO2 gas manifolds;

d. Delete all landscaping and irrigation;

e. Delete exterior window sun-shading devices (6);

f. Delete all bumper rails and corner guards (keep backing plates);

g. Substitute all pre-fabricated cladding panels (colored textured composite panels) for painted galvanized metal panels at all areas of occurrence, except at the Stairs. At the Stairs, infill openings with cast-in-place concrete.

h. Delete cement plaster at mechanical penthouse and rear side of screen wall, and replace with painted galvanized metal panels;

i. Delete wall protection panel system, and use latex acrylic paint;

j. Delete all light fixtures;

k. Delete all windows at stairs on the south façade;

l. Delete Abuse and Impact-Resistant Drywall in all areas. Instead, use Type X gypsum wall board in all areas;

m. Substitute acoustical ceiling tile for gypsum board ceilings in all areas except the Clean Cage Wash, the Soiled Cage Wash, and the Women's Locker/ Shower Room (all on the Ground Floor);

n. Substitute all high build epoxy finishes with latex acrylic paint in the Staging Area (#G10), Gowning Area (#G16), Hallways (#G15, #114), Air Lock ABSL-2 (#115), all Animal Holding Rooms, and all Procedure Rooms.

ITEM #3 - Deduct 2: Include everything in Deduct 2 and all work identified in Deduct 1. Deduct 2 includes:

a. Delete skim coating and painting the exterior building;

b. Delete asphalt pavement associated with the building site improvements;

c. Delete all fan coil units and chilled water piping from Telecom/Data Room; delete all fan units from piped utility and electrical rooms (maintain exterior louvers in walls);

d. Delete push plates automated doors to Cage Wash (doors G03 and G04) , Receiving Areas (G07B), and Feed and Bedding Storage (doors G05). Delete closers. Install conduit/ infrastructure only;

e. Change rubber flooring at stair landings to sealed concrete;

f. Delete hand wash sinks in First Floor hallway - retain waste and water stub out connections thru the face of wall;

g. Delete scope of commissioning the HVAC systems;

h. Delete the Access Control System;

i. Delete the CCTV System.

j. Delete the scope of Archeological Monitoring, as delineated in Section 1.1.A above.

ITEM #4 - Deduct 3 – Include everything in Deduct 3 and all work identified in Deduct 1, and Deduct 2. Deduct 3 includes:

a. Delete redundant AHU and controls (equipment pad and curb remains);

b. Delete the fire alarm system connection to the campus Fiber loop. Provide modem dial out to the campus fire and police;

c. Delete dedicated exhaust system serving Biosafety Cabinets in Procedure RM. 122, Rm. 101, Rm. 103;

d. Delete stand-by heating water pump, controls and electric power feed;

e. Delete stand-by heating water heat exchanger and associated controls;

f. Delete stand-by chilled water pump, controls and electric power feed;

g. Delete air valve Lab Control Panels and communication link to building DDC system. Adjust all air valve for stand alone CAV (constant air volume) control;

h. Delete the redundant space temperature sensors in the exhaust air duct from each animal holding area that were being used for environmental monitoring.

ITEM #5 - Deduct 4: Include everything in deduct 4 and all work identified in Deduct 1, Deduct 2, and Deduct 3. Deduct 4 includes:

a. Combine ABSL-2 areas (Animal Holding Room #113, Air Lock #115, and Procedure Room, #122) into (1) Storage Room;

b. Delete emergency power system;

c. Combine Procedure Room #105 with Animal Holding Room #112 into (1) Storage Room;

d. Change Men's Shower/ Locker Room (#G11) to a Storage Room;

ITEM #6 - Deduct 5: Include everything in deduct 5 and all work identified in Deduct 1, Deduct 2, Deduct 3, and Deduct 4. Deduct 5 includes:

a. Delete exterior glazing at Clean Cage Wash, Soiled Cage Wash, and Feed & Bedding Storage at Ground Floor of the north façade. Infill openings with colored metal panels;

b. Delete windows at Procedure Rooms on First Floor on the north façade. Infill openings with colored metal panels;

c. All floors to be sealed concrete, with the exception of the Clean Cage Area (G01), Clean Cage Wash (G03), Soiled Cage Wash (G04);

d. Shell the Clean Elevator (G19) and convert to a storage room.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

A. AFTER AWARD OF CONTRACT, an electronic set of specifications and drawings will be furnished to the contractor.

B. Hardcopy sets of drawings will be made by the Contractor at their own expense.

1.4 CONSTRUCTION SECURITY REQUIREMENETS

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.

2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.

2. For working outside the “regular hours” as defined in the contract, The General Contractor shall give 3 days notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.

3. No photography of VA premises is allowed without written permission of the Contracting Officer.

4. VA reserves the right to close down or shut down the project site and order General Contractor’s employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the COTR for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.

2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

D. Generally, locking hardware used here must be Class 1 and ADA compliant. Where key locks are required,

these locks must conform to the lock cylinders currently in use here; this means that the locks must accept our Best 7-pin interchangeable cores. The industry nomenclature for this would be:

“I/C small format 7 pin core”.

1. Door locks used throughout this installation are of two types: cylindrical and mortise. Cylindrical locks are preferred because they cost less, break down less often, and require a simpler door preparation. In addition, they leave a stronger door after they have been installed.

2. Exit hardware used on this station must also accept the Best cylinders mentioned above. Additionally, it should be surface mounted, and not mortise style. Vertical locking rods, when used, must also be surface mounted. Internal rods are prone to breakage and require door removal to repair.

3. We have found some brands of locks, exit hardware and door closers have proven more trouble-free than others. Following is a list of acceptable locks and functions:

Office Lock: Schlage ND53BD-626-RHO.

Function: Lock is always open on inside, locked by button on inside.

Storeroom Lock: Schlage ND80BD-626-RHO.

Function: always locked on outside, always open inside, key retracts Bolt.

Privacy Lock: Schlage ND40BD-626-RHO.

Function: Bathroom lock. Button locks from inside, coin or screwdriver unlocks. It cannot be left unlocked upon leaving room.

Passage Set: Schlage ND10S-626-RHO.

Function: Passage. Two levers, always unlocked.

Classroom Lock: Schlage ND70BD-626-RHO

Function: always open inside, Key lock and unlock outside.

4. For exit hardware, Von Duprin 99 series, surface mounted. Generally, storeroom function preferred; when hardware needs to be left unlocked it can be dogged down.

5. Occasionally we install mechanical combination locks. They are:

   Simplex Kaba lock, P/N# 1021B-26D-41. This number ensures that the lock will comply with our

   7-pin small format Best cylinders.

6. If we must use mortise locks, we require the Schlage L-series with lever handles, in brushed chrome finish (626). I can supply part numbers and other information upon request.

7. For door closers, I would recommend LCN heavy-duty.

E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of “sensitive information”.

2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.

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

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

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

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

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

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

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

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.

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):

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

2. National Fire Protection Association (NFPA):

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

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

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

   70-2007 .....National Electrical Code

   241-2004 .....Standard for Safeguarding Construction, Alteration, and Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

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

B. 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 COTR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the COTR that individuals have undergone contractor's safety briefing.

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

D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).

E. Temporary Construction Partitions:

1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas the areas that are described in phasing requirements and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.

2. Install one-hour temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.

3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.

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

G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COTR. See scope for maintaining pedestrian access through the construction site.

H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COTR.

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.

L. Sprinklers: Install, test and activate new automatic sprinklers.

M. Existing Fire Protection: N/A

N. Smoke Detectors: N/A

O. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COTR. Obtain permits from facility Safety through COTR at least 24 hours in advance. Designate contractor's superintendant to permit hot work.

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

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 areas. Attached is VA Medical Center San Francisco's Medical Center Smoking Policy.

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 COTR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

U. Above Ceiling Permit: N/A

V. Temporary Electrical: Contractors are not allowed to use power supplied VA unless approved by COTR. If approved, use and installations shall be in accordance with 29 CFR 1926, NFPA 241 and NFPA 70. At no time will VA approve temporary power connection from a critical electrical circuit.

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 COTR. 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 COTR 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. Contractor shall store any materials off site that cannot be maintained within the construction area.

C. The Contractor shall, under regulations prescribed by the COTR, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the COTR. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

D. Working space and space available for storing materials shall be as shown on the drawings or as determined by the COTR. Off-site storage of materials shall be the responsibility of the contractor if it cannot be contained within the space determined by the COTR.

E. Workmen are subject to rules of Medical Center applicable to their conduct. 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. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COTR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.

2. Schedule delivery of materials and equipment to immediate construction working areas for not more than 30 days. Further delivery of materials and equipment past 30 days to construction areas shall be left to the discretion of the COTR. Provide unobstructed access to Medical Center areas required to remain in operation.

3. N/A

G. Construction Safety Rounds: VA will perform Construction Safety Rounds weekly. Contractor superintendent or Contractor's Competent Person will be present during these safety inspections. COTR will identify the date and time of these weekly inspections.

H. Phasing: To insure such executions, Contractor shall furnish the COTR with a schedule of approximate milestones 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 COTR 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, COTR and Contractor, as follows:

I. Building(s) No. 17 will not be occupied during performance of work.

1. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.

2. N/A

J. 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 COTR Engineer.

K. 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 the Department of Veterans Affairs whichever will be required to respond to an alarm from Contractor's employee or watchman.

L. Utilities Services: Maintain existing utility services for 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 COTR.

1. No utility service such as water, gas, compressed air, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COTR. 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 COTR, in writing, 21 DAYS 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 COTR.

5. N/A

6. N/A

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

N. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least 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 COTR.

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

P. CONTRACT WORK HOURS and FEDERAL HOLIDAYS:

(a). Standard daily contract work hours at the San Francisco VA Medical Center (SFVAMC) are from 7:00 AM to 4:30 PM, Pacific Standard Time (PST), Monday through Friday, with the exception of Federal Holidays. The contractor shall submit to the Contracting Officer (CO) for approval, in writing, a notice of its desire to work during any period/hours other than the standard. Notice shall include a detailed description of the type of work to be performed and its location. These “non-standard” hours are referred to as “WHEN Hours” (Weekend-Holiday-Evening-Night). The notice requesting work during WHEN hours shall be submitted not less than two (2) working days prior to each period of work scheduled at times other than normal duty hours to include Federal holidays. Contractors are reminded that patients are generally asleep after 7:00 PM PST. Therefore, approval is subject to the availability of the project

manager/COTR, the type of work to be performed, the specific hours requested, and the anticipated noise level that will be generated by contractor activity. Under no circumstances will the contractor proceed without express written approval of the Contracting Officer.

1. Work Phasing/Scheduling: Contractor shall work closely with the COTR in developing a work schedule for contract performance. Simultaneous or transitional work on/between multiple facilities may be required. Advance coordination by the contractor is critical and required. **Note**, Concurrent work performance is anticipated on all line items for this project.

2. The work to be performed on this project will include occupied areas, however arrangements may be made so that the particular area may be blocked off during performance of work if feasible. The contractor shall notify the COTR of intent to start work in any specific assigned area. The contractor shall coordinate the work of all activities whereby both the Government and the contractor can continue operations with the least possible interference and inconvenience.

3. The contractor is required to have a minimum of crews for work covered by this contract, and provide additional crew(s) as the work justifies. Each crew shall be capable of operating simultaneously and independently of the other crew(s).

4. The following is a list of Federal Holidays observed by all Federal Installations:

New Year's Day, January 1

Martin Luther King, Jr, 3rd Monday in January

Washington's Birthday, 3rd Monday in February

Memorial Day, Last Monday in May

Independence Day, July 4

Labor Day, 1st Monday in September

Columbus Day, 2nd Monday in October

Veterans Day, November 11

Thanksgiving Day, 4th Thursday in November

Christmas Day, December 25

NOTE: Any of the above holidays falling on a Saturday will be observed on the preceding Friday; holidays falling on a Sunday will be observed on the following Monday. Also included is any date specifically declared by the President of the United States of America as a National Holiday.

COTR reserves the right to stop work on any of the listed holidays as seen fit in the overall protection of the SFVAMC campus.

1.7 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COTR, of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:

B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COTR and/or Supply Representative to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly.

C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COTR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:

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

D. Protection: Provide the following protective measures:

   1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.

   2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.

3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

E. Construction Barriers:

1. See design plans and scope of work for phasing.

F. 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.

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

1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in specifications as items to be stored. Items which 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.

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 COTR 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. In general, following preventive measures shall be adopted during construction to keep down dust.

   1. Dampen debris to keep down dust around construction site and around all pedestrian pathways designated by COTR.

   2. Do not perform dust producing tasks within occupied areas without the approval of the COTR.

   3. 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.

D. N/A

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. All new air ducts shall be cleaned prior to final inspection.

1.9 DISPOSAL AND RETENTION

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

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

2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.

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

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

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

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 COTR may have the necessary work performed and charge the cost to the Contractor.

C. 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.

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 COTR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COTR 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. N/A

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 HDR Architecture Inc.

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 provided as an attachment. See attachment Soli Rock profiling report 5-6-2011.

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. 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.

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.

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 COTR 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 COTR before any major items of concrete work are placed. In addition, Contractor shall also furnish to the COTR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.

1. Lines of each building and/or addition.

2. Elevations of bottoms of footings and tops of floors of each building and/or addition.

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

4. Lines of elevations of all swales and interment areas.

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

E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to COTR.

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 one 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 COTR'S review, as often as requested.

C. Contractor shall deliver two approved completed sets of as-built drawings to the COTR within 15 calendar days after each completed phase and after the acceptance of the project by the COTR.

D. N/A

1.16 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COTR, 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 PRECONSTRUCTION RISK ASSESSMENT

For every construction project, the Contractor and the COTR are required to perform a Pre-Construction Risk Assessment (PCRA). The contractor must submit the PCRA within 15 days from issuance of the Notice to Proceed.

1.18 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:

1. Permission to use each unit or system must be given by COTR. If the equipment is not installed and maintained in accordance with the following provisions, the COTR will withdraw permission for use of the equipment.

2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly

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

3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.

4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.

5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.

6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government. Boilers, pumps, feedwater heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel. Boiler water must be given complete and continuous chemical treatment.

B. Prior to final inspection, 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.

1.19 TEMPORARY USE OF EXISTING ELEVATORS

N/A

1.20 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 COTR 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 COTR.

3. Submit to the COTR 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 COTR 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 COTR 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.

1.21 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 COTR, 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.

B. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center or COTR. Contractor shall keep such places clean and be responsible for

any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.22 AVAILABILITY AND USE OF UTILITY SERVICES

A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract.

B. N/A

C. N/A

D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:

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

a. Steam is available at no cost to Contractor.

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

1. Obtain electricity by connecting to the Medical Center electrical distribution system. Electricity for all other uses is available at no cost to the Contractor.

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

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

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

H. Fuel: N/A

1.23 NEW TELEPHONE EQUIPMENT

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

1.24 TESTS

A. Pre-test mechanical and electrical equipment and systems 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.

1.25 INSTRUCTIONS

A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.

B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the COTR 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 COTR and shall be considered concluded only when the COTR 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 COTR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.26 GOVERNMENT-FURNISHED PROPERTY

N/A

1.27 RELOCATED EQUIPMENT OR ITEMS

N/A

1.28 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT

N/A

1.29 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 shall be discussed with the Resident Engineer.

1.30 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 will be discussed with the Resident Engineer.

E. Post the number of accident free days on a daily basis.

1.31 CONSTRUCTION DIGITAL IMAGES

N/A

1.32 FINAL ELEVATION DIGITAL IMAGES

N/A

1.33 HISTORIC PRESERVATION

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

1.34 PARKING

There will be no designated parking space on site available to the contractor for staging, container, debris box, or any motor vehicle.

1.35 ID BADGES

Contractors and workers are required to wear badges on site at all times. Badges are issued from police service and through the COTR.

1.36 RADIOLOGY AND BIO SAFETY

N/A

1.37 CONSTRUCTION SCHEDULE

A. The Contractor shall develop a Construction Schedule demonstrating fulfillment of contract requirements, shall keep the schedule up-to-date as required in this Article, and shall utilize the schedule for coordinating and monitoring work under the Contract (including activities of subcontractors, vendors, and suppliers). The schedule shall be prepared in the format of a Gantt or Bar Chart, utilizing Microsoft Project or similar computer application, subject to approval by the Resident Engineer.

B. Within 10 calendar days after receipt of Notice to Proceed, the Contractor shall submit a complete Construction Schedule for review by the Contracting Officer under provisions of Section 01340, SAMPLES AND SHOP DRAWINGS. Submit three copies on sheets of paper 750 mm by 1050 mm (30 by 42 inches). Within 10 calendar days of receipt of the Construction Schedule, the Contracting Officer or his representative will return the submittal with any comments or objections, and if appropriate, schedule a meeting with the Contractor for joint review, correction, or adjustment of the schedule. Within 14 calendar

days after the later of the return of the submittal or the joint review meeting, the Contractor shall revise and submit three copies of the revised schedule for the Contracting Officer's approval.

C. The Construction Schedule shall show construction activities in sufficient detail to monitor work progress, to support application and certificates for payment, and to coordinate submittal review, inspection, and other activities of the Resident Engineer and his consultants. As a minimum, it will contain the level of detail shown in the Sample Construction Schedule Drawing CS-1, which is a sample only, derived from a different project and not to be used as is for this project. Activities shall be identified by trade and nature of task, and shall show durations for the activity from allowable early-start and late-start to early-finish and late-finish, with graphic distinctions between these durations made by color or pattern.

D. The Contractor shall update the Construction Schedule on a monthly basis, and shall submit an updated schedule with each payment request. Monthly job progress meetings shall be held on dates mutually agreed to by the Contracting Officer, or his representative, and the Contractor. An updated schedule shall be furnished by the Contractor to the VA at least three working days prior to the meeting. At the meeting, job progress will be reviewed to verify: actual start or finish dates for activities completed or in progress; remaining duration required to complete activities in progress or scheduled to start; and percentage complete for activities in progress. Any changes required to the schedule due to discrepancies between actual job progress and the schedule shall be reported by the Contractor, reviewed, and submitted for approval to the Contracting Officer. Any corrective actions in terms of increased manpower, shift hours, work days, or other measures necessary to maintain phasing or contract completion dates shall be reported by the Contractor, reviewed, and included in proposed schedule changes.

E. N/A

1.38 DAILY LOGS

A. Permit and Daily Construction check list

B. Workers present and work taking place during day at project.

C. Submit daily logs electronically on a weekly basis.

Egress Routes for Construction Workers should be inspected daily. Report findings and corrective actions weekly to the COTR.

The Contracting Officer should refer to VA Handbook 0100 see http://www1.va.gov/oamm/policy0100h.ht, dated July 3, 2000, which requires that "Products manufactured to metric dimensions will be considered on an equal basis with those using inch/pound units, providing they fall within the tolerances specified using conversion tables contained in the latest revision of Federal Standard No. 376B, an all other requirements of this document are met. If a product is manufactured to metric dimensions and those dimensions exceed the tolerances specified in the inch/pound units, a request should be made to the contracting officer to determine if the product is acceptable. The contracting officer, in concert with contracting Officer's Technical Representative (COTR), will accept or reject the product."

- - - E N D of S E C T I O N- - -

SECTION 01 33 00.01
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Submittal Procedures and Quantities Required.

B. Schedule of Submittals.

C. Shop Drawings.

D. Product Data.

E. Samples.

F. Submittal Review.

G. Informational Submittals.

1.2 RELATED SECTIONS

A. Section 01 00 00 – General Requirements

B. Section 01 45 29 - Testing Laboratory Services, for testing and inspection report submittals.

C. Section 01 79 00.01 – System Demonstrations, for demonstration and instruction statement submittals.

1.3 SUBMITTAL PROCEDURES AND QUANTITIES REQUIRED

A. General: Electronic copies of CAD Drawings of the A/E's Construction Drawings may be provided by A/E for Contractor's use in preparing submittals, subject to terms and conditions contained in the General Conditions and/or Supplementary General Conditions.

B. Transmit each submittal under Transmittal Form format as mutually agreed upon by Architect and CM/GC. See sample copy at end of this Section.

C. Sequentially number transmittal forms. On re-submittals, add alphabetic suffix to original number.

D. Identify Project, Installer or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, title and paragraph number as appropriate. Identify product using same terminology as specification.

E. Provide space for Installer, contractor and A/E review stamps.

F. Apply [Contractor] stamp. Sign or initial to certify that review, verification of products required, field dimensions, adjacent construction, and coordination of information are in accordance with requirements of the Work and Contract Documents. Submittals made without certification of [Contractor's] review and verification will be returned without review.

G. Identify variations from Contract Documents, and product or system limitations which may be detrimental to successful performance of completed work.

H. Revise and resubmit only those submittals stamped: "Revise and Resubmit" and "Rejected". Identify all changes made since previous submittal.

I. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.

J. Submittals not requested, or previously stamped "Approved" or "Approved as Noted" by the A/E, will not be processed or returned.

K. Submittal Quantities:
   1. Construction Progress Schedules: 3 copies.
   2. Schedule of Submittals: 3 copies.
   3. Shop Drawings: 4 copies.
   4. Product Data: Number of copies [Contractor] requires, plus 3 copies which will be retained by A/E. Maximum total copies: 6.
   5. Samples: 3 sets unless specified otherwise. One will be retained by A/E and one will be retained at site.
   6. Project Record Documents: 2 copies.
   7. Operation and Maintenance Data: 2 copies for initial review (one retained by A/E). 6 copies for final approval and distribution (one retained by A/E, 4 to Owner and one returned to [Contractor] .
   8. Other Informational Submittals: 3 copies.

L. Shop drawings received after 12 noon will be logged in as received next business day. Turnaround time will begin on logged as received and end on day when sent out.

1.4 SCHEDULE OF SUBMITTALS

A. Submit proposed schedule of submittals (including, but not limited to, Shop Drawings, Product Data, and Samples). IT IS A MANDATORY REQUIREMENT THAT THIS SCHEDULE BE SUBMITTED, IN WRITING, TO THE A/E SUFFICIENTLY IN ADVANCE OF COMMENCEMENT OF THE FIRST PROJECT SUBMITTAL TO ALLOW FOR THE A/E'S TIMELY REVIEW AND ACTION. Absent a mutually agreed upon Submittals Schedule between the A/E and the Contractor, the A/E, at its sole discretion, shall determine a period of review for submittals which is reasonably required to permit the A/E and/or its sub-consultants to exercise due diligence required by the A/E's normal standard of care with respect to its review process.
   1. Such Submittals Schedule shall be mutually agreed upon, in writing, by authorized representatives of the A/E and the Contractor.
   2. Schedule shall be in horizontal bar chart form divided by weeks.
   3. Schedule shall allow for the orderly, consistent and proper review of submittals, including time for resubmittals, by the A/E and/or its sub-consultants in a timely manner.
   4. Coordinate each submittal with fabrication purchasing, testing, delivery, other submittals and related activities that require sequential activity.
   5. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   6. The A/E reserves the right to withhold action on a submittal which, in the A/E's opinion, requires coordination with other submittals until related submittals are received, and will notify the Contractor, in writing, when he exercises this right.
   7. Shop Drawings: Schedule shall identify Shop Drawings by Section Number, and shall indicate approximate number of drawings, plus or minus 5 percent, that will be submitted each week.
      a. Should the number of Shop Drawing sheets submitted by the Contractor exceed the approximate numbers indicated in the approved Submittals Schedule, the period for review for such submittals shall be extended as reasonably required to permit the A/E and/or its sub-consultants to exercise the due diligence required by the A/E's normal standard of care with respect to its review of shop drawings.

b. Should such an extended period for Shop Drawing review be made necessary due to the Contractor's submission of Shop Drawing sheets in excess of the numbers permitted by the approved Submittals Schedule or its failure to properly coordinate the timing and sequence of its submittals with the actual timing, sequence and progress of the Work, such extension of time shall not constitute a delay on the part of the A/E or its sub-consultants.

8. Product Data and Samples: List by Section Number, those products requiring data and sample submission. Quantity estimate not required.

EXAMPLE:

Spec Section	Item	January				February				March			
03 20 00	Reinforcing Steel Shop Drawings		3	2	6	12	1						
05 12 10	Structural Steel Shop Drawings					2	12	20	20	10			
07 16 00	Dampproofing Product Data										X		
07 41 13	Metal Wall Panel Samples							X					
23 31 13	Ductwork Shop Drawings						12	50	17	30	30	6	

1.5 SCHEDULE OF PRODUCTS

A. Submit a complete schedule of products proposed for use, with name of manufacturer, trade name, model number and reference standard of each product. Arrange products in the schedule by specification sections; indicate paragraph where specified.

B. Submit within 15 days after Notice to Proceed.

C. Do not use Products Schedule to obtain approval of substitute products.

D. Submit Final Products Schedule, indicating actual products used in project, as part of project closeout. Comply with Section 01 78 39.01 .

1.6 SHOP DRAWINGS

A. Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data. If A/E drawings are submitted as shop drawings, remove A/E title block. Use of A/E drawings does not relieve Contractor of responsibility to ensure all provisions of Contract Documents have been complied with.

B. After review, reproduce and distribute in accordance with Article 1.03 on Procedures above and for Record Documents described in Section 01 78 39.01 .

1.7 PRODUCT DATA

A. Submit only pages which are pertinent. Mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number. Show compliance with specified reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances; notation of coordination requirements.

B. Delete those items on manufacturer's standard sheets which are not being proposed. Submittals without indications and deletions will be returned without review.

C. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable. If manufacturer’s standard documents are modified, they shall be submitted as Shop Drawings, not as Product Data.

D. Submit Product Data before or concurrent with Samples.

E. After review, distribute in accordance with Article 1.03 on Procedures above. Provide copies for Record Documents described in Section 01 78 39.01 .

1.8 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

B. When specific colors, textures, or patterns are not specified, submit samples from full range of manufacturer's standards for selection. When custom or standard finishes are specified, submit samples of specified colors, textures or patterns.

C. Include identification on each sample, with full Project information, manufacturer's name, model number, or other identifying method.

D. Reviewed samples which may be used in the Work are indicated in individual Sections.

1.9 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual Sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing.

B. Identify conflicts between manufacturer's instructions and Contract Documents.

1.10 CERTIFICATES

A. When specified in individual Sections, submit certifications or regulatory agency certificates of inspection as specified.

B. Certificates shall be signed, dated, and identified with project name.

1.11 SUBMITTAL REVIEW

A. A/E will review and stamp shop drawings, product data and samples in one of the following ways:
   1. "APPROVED": Submittal is in general conformance with the design concept of the Project and in general compliance with information given in the Contract Documents.
   2. "APPROVED AS NOTED": Submittal has minor error. Noted corrections must be made in final installation. A/E has option to require re-submission for record.
   3. "REVISE AND RESUBMIT": Re-submission is required, due to nature or number of errors.
   4. "REJECTED": Submittal does not meet contract requirements. Re-submittal is required.

B. Work may be executed under categories; "APPROVED" or "APPROVED AS NOTED" only. The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the A/E. Such Work shall be in accordance with approved submittals.

C. Review and approval of submittals does not relieve the Contractor from the obligation to comply with the Contract Documents unless the Contractor has specifically informed the A/E in writing of such deviation at the time of submittal and the A/E has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the A/E's approval thereof.

D. The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the A/E on previous submittals.

E. If a submittal must be delayed for coordination with other submittals not yet submitted, the A/E may at his/her option either return the submittal with no action or notify the Contractor of the other submittals which must be received before the submittal can be reviewed. If such action is taken by the A/E, the Contractor shall not submit action by A/E as the reason for cause of delay in the Work.

1.12 INFORMATIONAL SUBMITTALS

A. Submittals listed below are considered informational, and will not be stamped by A/E in same manner as shop drawing, product data or samples. Informational submittals require no responsive action by A/E except as stated.
   1. Manufacturer's Installation or Adjustment Instructions.
   2. Statements of Qualifications.
   3. Certificates.
   4. Field Service, Laboratory Test, Start-Up Reports, Demonstration and Instruction Statements.
   5. Demonstration and Instruction Statement from Owner.
   6. Project Record Documents.
   7. Operation and Maintenance Data.
   8. Warranties and Bonds.
   9. Progress Schedules.
   10. Design Calculations.
   11. Other submittals, including certain shop drawings and product data, specifically identified as "Informational".

B. A/E will make a preliminary examination of design calculations, only to determine whether applicable performance criteria given in the Contract Documents have been addressed and applied to the degree necessary to meet intent of Contract Documents.
   1. A/E will not investigate or inquire into certifications or professional statements of consultant preparing such design calculation.
   2. Based upon such examination, A/E reserves right to investigate, re-calculate and otherwise comment as it sees fit. In event of such A/E action, Contractor retains full responsibility for compliance with the Contract Documents and for integrity of its work and resulting construction. A/E by such action, assumes no responsibility for Contractor's work.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

See Sample Submittal Data Sheet on next page.

SAMPLE

SUBMITTAL DATA SHEET

Project Name: _____

Location: _____

Architect/Engineer's Project No.: _____

Submittal No.: _____

First Submittal Date: _____

Resubmission Date: _____

Reference Specification No.: _____

Item Submitted: _____

_____

Contractor: _____

_____

Subcontractor/Installer: _____

_____

Supplier/Manufacturer: _____

_____

Deviations from Contract Documents: (Describe in Detail, if there is no deviation from Contract Documents, state "No Deviations").

Person sending this Transmittal _____
(Print name and affiliation)

_____
(Signature)

_____

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

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

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

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

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

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

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

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

1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by Resident Engineer 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 and shall contain the list of items, name of the project, 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 building , 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 Resident Engineer and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
5. Laboratory test reports shall be sent directly to Resident Engineer 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 Resident Engineer 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 building 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:

HDR

560 Mission St, Suite 900

San Francisco, CA. 94105

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 Resident Engineer.

END OF SECTION

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

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

A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to – GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.

B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

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

A. The specifications and standards cited in this solicitation can be examined at the following location:
DEPARMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
811 Vermont Avenue, NW - Room 462
Washington, DC 20420
Telephone Numbers: (202) 461-8217 or (202) 461-8292
Between 9:00 AM - 3:00 PM

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

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

AA	Aluminum Association Inc. http://www.aluminum.org
AABC	Associated Air Balance Council http://www.aabchq.com
AAMA	American Architectural Manufacturer's Association http://www.aamanet.org

AAN	American Nursery and Landscape Association http://www.anla.org
AASHTO	American Association of State Highway and Transportation Officials http://www.aashto.org
AATCC	American Association of Textile Chemists and Colorists http://www.aatcc.org
ACGIH	American Conference of Governmental Industrial Hygienists http://www.acgih.org
ACI	American Concrete Institute http://www.aci-int.net
ACPA	American Concrete Pipe Association http://www.concrete-pipe.org
ACPPA	American Concrete Pressure Pipe Association http://www.acppa.org
ADC	Air Diffusion Council http://flexibleduct.org
AGA	American Gas Association http://www.aga.org
AGC	Associated General Contractors of America http://www.agc.org
AGMA	American Gear Manufacturers Association, Inc. http://www.agma.org
AHAM	Association of Home Appliance Manufacturers http://www.aham.org
AISC	American Institute of Steel Construction http://www.aisc.org
AISI	American Iron and Steel Institute http://www.steel.org
AITC	American Institute of Timber Construction http://www.aitc-glulam.org
AMCA	Air Movement and Control Association, Inc. http://www.amca.org
ANLA	American Nursery & Landscape Association http://www.anla.org
ANSI	American National Standards Institute, Inc. http://www.ansi.org
APA	The Engineered Wood Association http://www.apawood.org
ARI	Air-Conditioning and Refrigeration Institute http://www.ari.org
ASAE	American Society of Agricultural Engineers http://www.asae.org
ASCE	American Society of Civil Engineers http://www.asce.org
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASSE	American Society of Sanitary Engineering http://www.asse-plumbing.org
ASTM	American Society for Testing and Materials http://www.astm.org

AWI	Architectural Woodwork Institute http://www.awinet.org
AWS	American Welding Society http://www.aws.org
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIA	Brick Institute of America http://www.bia.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CI	The Chlorine Institute, Inc. http://www.chlorineinstitute.org
CISCA	Ceilings and Interior Systems Construction Association http://www.cisca.org
CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org
CLFMI	Chain Link Fence Manufacturers Institute http://www.chainlinkinfo.org
CPMB	Concrete Plant Manufacturers Bureau http://www.cpmb.org
CRA	California Redwood Association http://www.calredwood.org
CRSI	Concrete Reinforcing Steel Institute http://www.crsi.org
CTI	Cooling Technology Institute http://www.cti.org
DHI	Door and Hardware Institute http://www.dhi.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EEI	Edison Electric Institute http://www.eei.org
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.et1.com
FAA	Federal Aviation Administration http://www.faa.gov
FCC	Federal Communications Commission http://www.fcc.gov
FPS	The Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.cssinfo.com/info/gana.html/
FM	Factory Mutual Insurance http://www.fmglobal.com
GA	Gypsum Association http://www.gypsum.org

GSA	General Services Administration http://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
HPVA	Hardwood Plywood & Veneer Association http://www.hpva.org
ICBO	International Conference of Building Officials http://www.icbo.org
ICEA	Insulated Cable Engineers Association Inc. http://www.icea.net
\ICAC	Institute of Clean Air Companies http://www.icac.com
IEEE	Institute of Electrical and Electronics Engineers http://www.ieee.org\
IMSA	International Municipal Signal Association http://www.imsasafety.org
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association http://www.mbma.com
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. http://www.mss-hq.com
NAAMM	National Association of Architectural Metal Manufacturers http://www.naamm.org
NAPHCC	Plumbing-Heating-Cooling Contractors Association http://www.phccweb.org.org
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors http://www.nationboard.org
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association http://www.nema.org
NFPA	National Fire Protection Association http://www.nfpa.org
NHLA	National Hardwood Lumber Association http://www.natlhardwood.org
NIH	National Institute of Health http://www.nih.gov
NIST	National Institute of Standards and Technology http://www.nist.gov
NLMA	Northeastern Lumber Manufacturers Association, Inc. http://www.nelma.org
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604
NSF	National Sanitation Foundation http://www.nsf.org
NWWDA	Window and Door Manufacturers Association http://www.nwwda.org

OSHA	Occupational Safety and Health Administration Department of Labor http://www.osha.gov
PCA	Portland Cement Association http://www.portcement.org
PCI	Precast Prestressed Concrete Institute http://www.pci.org
PPI	The Plastic Pipe Institute http://www.plasticpipe.org
PEI	Porcelain Enamel Institute, Inc. http://www.porcelainenamel.com
PTI	Post-Tensioning Institute http://www.post-tensioning.org
RFCI	The Resilient Floor Covering Institute http://www.rfci.com
RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. http://www.rma.org
SCMA	Southern Cypress Manufacturers Association http://www.cypressinfo.org
SDI	Steel Door Institute http://www.steeldoor.org
IGMA	Insulating Glass Manufacturers Alliance http://www.igmaonline.org
SJI	Steel Joist Institute http://www.steeljoist.org
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. http://www.smacna.org
SSPC	The Society for Protective Coatings http://www.sspc.org
STI	Steel Tank Institute http://www.steeltank.com
SWI	Steel Window Institute http://www.steelwindows.com
TCA	Tile Council of America, Inc. http://www.tileusa.com
TEMA	Tubular Exchange Manufacturers Association http://www.tema.org
TPI	Truss Plate Institute, Inc. 583 D'Onofrio Drive; Suite 200 Madison, WI 53719 (608) 833-5900
UBC	The Uniform Building Code See ICBO
UL	Underwriters' Laboratories Incorporated http://www.ul.com
ULC	Underwriters' Laboratories of Canada http://www.ulc.ca

WCLIB	West Coast Lumber Inspection Bureau 6980 SW Varns Road, P.O. Box 23145 Portland, OR 97223 (503) 639-0651
WRCLA	Western Red Cedar Lumber Association P.O. Box 120786 New Brighton, MN 55112 (612) 633-4334
WWPA	Western Wood Products Association http://www.wwpa.org

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION

SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 APPLICABLE PUBLICATIONS

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

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

T27-06	Sieve Analysis of Fine and Coarse Aggregates
T96-02 (R2006)	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
T99-01 (R2004)	The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
T104-99 (R2003)	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
T180-01 (R2004)	Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
T191-02(R2006)	Density of Soil In-Place by the Sand-Cone Method

C. American Concrete Institute (ACI):

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

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

A325-06	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A370-07	Definitions for Mechanical Testing of Steel Products
A416/A416M-06	Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
A490-06	Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
C31/C31M-06	Making and Curing Concrete Test Specimens in the Field
C33-03	Concrete Aggregates
C39/C39M-05	Compressive Strength of Cylindrical Concrete Specimens
C109/C109M-05	Compressive Strength of Hydraulic Cement Mortars
C138-07	Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C140-07	Sampling and Testing Concrete Masonry Units and Related Units
C143/C143M-05	Slump of Hydraulic Cement Concrete
C172-07	Sampling Freshly Mixed Concrete
C173-07	Air Content of freshly Mixed Concrete by the Volumetric Method
C330-05	Lightweight Aggregates for Structural Concrete
C567-05	Density Structural Lightweight Concrete
C780-07	Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019-08	Sampling and Testing Grout
C1064/C1064M-05	Freshly Mixed Portland Cement Concrete
C1077-06	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

C1314-07	Compressive Strength of Masonry Prisms
D698-07	Laboratory Compaction Characteristics of Soil Using Standard Effort
D1143-07	Piles Under Static Axial Compressive Load
D1188-07	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D1556-07	Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557-07	Laboratory Compaction Characteristics of Soil Using Modified Effort
D2166-06	Unconfined Compressive Strength of Cohesive Soil
D2167-94(R2001)	Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2216-05	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2922-05	Density of soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D2974-07	Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
D3666-(2002)	Minimum Requirements for Agencies Testing and Inspection Bituminous Paving Materials
D3740-07	Minimum Requirements for Agencies Engaged in the Testing and Inspecting Road and Paving Material
E94-04	Radiographic Testing
E164-03	Ultrasonic Contact Examination of Weldments
E329-07	Agencies Engaged in Construction Inspection and/or Testing
E543-06	Agencies Performing Non-Destructive Testing
E605-93(R2006)	Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
E709-(2001)	Guide for Magnetic Particle Examination
E1155-96(R2008)	Determining FF Floor Flatness and FL Floor Levelness Numbers

E. American Welding Society (AWS):

D1.1-07	Structural Welding Code-Steel

1.3 REQUIREMENTS

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

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Resident Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure. Any re-testing required will be at the cost of the Contractor.

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

D. Verbal Reports: Give verbal notification to Resident Engineer 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 Resident Engineer regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Resident Engineer 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 full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.

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 D1557.
   2. Make field density tests in accordance with the primary testing method following ASTM D2922 wherever possible. Field density tests utilizing ASTM D1556 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the Resident Engineer before the tests are conducted.
      a. Building Slab Subgrade: At least one test of subgrade for every 185 m^2 (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 m^2 (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 m^2 (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: Building and retaining wall footings shall be excavated to rock or competent subgrade and visually observed by Geotechnical Engineer's representative .

C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.

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

3.2 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.
3. Provide Test A05, for agricultural suitability, fertility, particle size analysis; including recommendations for soil amendment and backfilling, and fertilization during Maintenance Period. Number of samples to be as recommended by Testing Laboratory, minimum 4 samples.
4. Perform monocot and dicot growth trials, Test M05. Number of samples as recommended by Testing Laboratory, minimum 4 trials.

B. Certify that soil is free of herbicides or other harmful substances.

C. Provide Project Specifications for import topsoil, soil amendments and fertilizer to Testing Laboratory along with samples of import topsoil. Include manufacturer's analysis of proposed amendment, dated within 6 months before delivery, or sample of organic amendment for Testing Laboratory's analysis if manufacturer's analysis is not available.

D. Testing Laboratory shall propose changes in amendment program specified, if required, and shall certify that amendments proposed are suitable for use with site soil and import topsoil.

E. Import soil (only if determined that site soil is unsuitable): Submit test reports of representative sample prior to delivery and for every 100 yards delivered to the site. Test A05, for agricultural suitability, fertility, particle size analysis; including recommendations for soil amendments, and fertilization during Maintenance Period.
   1. Testing Laboratory shall certify that proposed import topsoil complies with Specifications and that it is compatible with site soil.

F. All other fertilizers and amendments: For standard products, submit manufacturer's analysis. For all other products, submit analysis by Testing laboratory.

G. Submit test results, analysis and recommendations for site soil, import soil, fertilizer and organic amendment together, as a package.

3.3 ASPHALT CONCRETE PAVING

A. Aggregate Base Course:
   1. Determine maximum density and optimum moisture content for aggregate base material in accordance with AASHTO T180, Method D or 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 AASHTO T191 or 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.

3.4 SITE WORK CONCRETE

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

3.5 CONCRETE

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

B. Field Inspection and Materials Testing:
   1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
   2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
   3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m^3 (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type, and at least once for each 2000 sq. ft. of surface area for walls and slabs. Label each cylinder with an identification number. Resident Engineer may require additional cylinders to be molded and cured under job conditions.
   4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
   5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m^3 (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m^3 (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
   6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
   7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
   8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
   9. Verify that specified mixing has been accomplished.
   10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:

a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.

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

1. Submit concrete materials and concrete mix designs proposed for use. Include results of testing performed to qualify materials and to establish mix designs. Place no concrete until Contractor has received approval in writing. See submittals paragraph.
2. Use of testing service shall in no way relieve Contractor of responsibility to furnish materials and construction in full compliance with Contract Documents.
3. To facilitate testing and inspection:
    a. Furnish labor to assist Owner's testing agency in obtaining and handling samples at site or other sources of materials.
    b. Advise Owner's testing agency sufficiently in advance of operations to allow for completion of routine testing and for assignment of personnel.
    c. Provide and maintain adequate facilities for safe storage and proper curing of concrete compressive strength test specimens on site for first 8 HR or until they gain sufficient strength, as required by ASTM-C31.

4. Pay for following additional testing services to be performed by Owner's testing agency, on occasions indicated:
    a. Additional testing and inspection, whenever changes in materials or proportions are requested by Contractor.
    b. Additional testing of materials or concrete, whenever they fail by test or inspection, to meet specification requirements.
    c. Other testing services needed or required by Contractor, such as:
        1) Additional field cured test specimens as needed for control of work by Contractor such as, when concrete may be stripped, reshored, unshored, etc.

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

E. EVALUATION AND ACCEPTANCE OF COMPRESSIVE STRENGTH TEST RESULTS
1. Evaluate test results for standard molded and cured test cylinders separately for each concrete mix design. For evaluation of potential strength and uniformity, each mix design shall be represented by at least five tests.
2. Strength level of concrete will be considered acceptable so long as averages of sets of three consecutive strength test results equal or exceed specified strength (f'c) and no individual strength test result falls below specified strength (f'c) by more than 3450 kPa 500 PSI.

F. TESTING CONCRETE IN PLACE
1. When compressive strength tests indicate potential strength deficiency of in-place concrete, testing of concrete in place may be required as an aid in evaluating actual strength. If required, Contractor pay for concrete tests and engineering time and analysis required to evaluate actual in-place concrete strength made necessary by deficient strength cylinder tests.
2. Testing by rebound hammer, ultrasonic, or other non-destructive device: Such tests shall be used to determine relative strengths at various locations in structure as an aid for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, will not be used as a basis for acceptance or rejection.

3. Core tests: Obtain and test largest practical diameter cores, 50 mm 2 IN minimum, in accordance with ASTM-C42. If concrete in structure will be dry under service conditions, air dry cores temperature 16 to 26 degC 60 to 80 degF, relative humidity less than 60 percent for 7 days before test. Test dry. If concrete in structure will be more than superficially wet under service conditions, test cores after moisture conditioning.
    a. Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient in strength. Location will be determined by Architect/Engineer. If, before testing, one or more of cores indicates evidence of having been damaged subsequent to or during removal from structure, replace it.
    b. Concrete in area represented by a core test will be considered acceptable if average strength of cores is equal to at least 85 percent of, and if no single core is less than 75 percent of, specified strength (f'c).
    c. Fill core holes with low slump patching compound .

G. ACCEPTANCE OR REJECTION OF CAST-IN-PLACE CONCRETE
1. General:
    a. Completed concrete work which conforms to applicable requirements of Contract Documents will be accepted without qualification.
    b. Concrete work which fails to conform to one or more requirements of Contract Documents is rejected and will not be accepted until remedied in accordance with 3.4 B, 3.4 C, and 3.4 D.
    c. Contractor pays costs incurred in providing remedial work necessary to change rejected work to accepted work. Remedial work includes, but is not necessarily limited to, applicable repairs, replacement, reinforcement, engineering, and testing as denoted in following paragraphs.
2. Dimensional tolerances:
    a. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances are potentially deficient in strength and subject to provisions of Paragraph 3.4 D.
    b. Formed surfaces resulting in concrete outlines larger than permitted by tolerances will be rejected if strength or finish of structure is not acceptable, or function is adversely affected. Otherwise members will be accepted. If surfaces are rejected, and removal of excess material is permitted, repair of surfaces in an approved manner will constitute acceptance. If surfaces are rejected, and removal of excess material is not permitted, replacement of member(s) in an approved manner will constitute acceptance.
    c. Concrete member(s) cast in wrong location will be rejected if strength or finish is not acceptable, function is adversely affected or they interfere with other construction. Otherwise, member(s) will be accepted. If they are rejected, replacement of member(s) in an approved manner and in conformance with Contract Documents will constitute acceptance.
    d. Inaccurately formed concrete surfaces exceeding limits of tolerances and which are exposed to view will be rejected. Repair of surfaces or replacement of member(s) in an approved manner and in conformance with Contract Documents will constitute acceptance.
3. Finish:
    a. Slabs:
        1) Finished slabs exceeding tolerance limits of Section 03 30 00 will be rejected if finish is not acceptable and function is adversely affected. If rejected, repair of finished surfaces or replacement of slab in an approved manner and in conformance with Contract Documents will constitute acceptance.
        2) Repair may involve removing high spots with a terrazzo grinder, filling low spots with a patching compound, or other remedial measures as permitted.
    b. Formed surfaces:

1) Concrete exposed to view with defects which adversely affect appearance of specified finish will be rejected. Repair of surface defects in conformance with Section 03 35 00 will constitute acceptance.
2) Concrete not exposed to view is not subject to rejection for defective finish.

4. Strength of structure:
   a. Strength of structure in place will be considered potentially deficient and will be rejected if it fails to comply with requirements which control strength of structure, including but not necessarily limited to following:
      1) Deficient concrete strength based on compressive strength tests.
      2) Reinforcing steel size, quantity, strength, position, or arrangement at variance with requirements on reinforcement.
   b. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
   c. Curing less than that specified, likely to result in deficient concrete strength.
   d. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
   e. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.
   f. Substandard workmanship likely to result in deficient strength.
5. When strength of structure is considered potentially deficient and is rejected, it will not be accepted until one of following remedies is completed. All proposed fixes to repair deficient concrete should be submitted by Contractor to Engineer for review and approval prior to any action by Contractor.
   a. Confirmation of safety of structure by structural analysis.
   b. Core tests per 3.3 C. Performed only when concrete strength is potentially deficient, and when safety of structure is not confirmed by structural analysis. Do not use if impractical to obtain or not feasible.
   c. Confirmation of safety of structure by load tests performed and evaluated in accordance with ACI 318. Do not use if impractical to perform or not feasible.
   d. Replacement of structure deficient in strength.
   e. Subject to functional feasibility and Owner's approval, structure deficient in strength may be reinforced with supplement supports as directed by Architect.

3.6 REINFORCEMENT

A. Review mill test reports furnished by Contractor.

B. 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).

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

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

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

3.7 SHOTCRETE

A. Inspection and Material Testing:

B. Provide field inspection and testing service as required by Resident Engineer to certify that shotcrete has been applied in accordance with contract documents.

C. Periodically inspect and test proportioning equipment for accuracy and report deficiencies to Resident Engineer.

D. Sample and test mix ingredients as necessary to insure compliance with specifications.

E. Sample and test aggregates daily and as necessary for moisture content. Report instances of excessive moisture to Resident Engineer.

F. Certify, in duplicate, that ingredients and proportions and amounts of ingredients in shotcrete conform to approved trial mixes.

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

H. Shotcrete Sampling:

I. Provide a technician at site of placement to perform shotcrete sampling.

J. Take cores in accordance with ACI 506.

K. Insure maintenance of water-cement ratio established by approved trial mix.

L. Verify specified mixing has been accomplished.

M. Laboratory Tests of Field Sample Panels:

N. 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.

O. Submit certified compression test reports (duplicate) to Resident Engineer. On test report, indicate following information:

P. Core identification number and date cast.

Q. Specific location at which test samples were taken.

R. Compressive strength of shotcrete in MPa (psi).

S. Weather conditions during placing.

T. Temperature of shotcrete in each test core when test core was taken.

U. Maximum and minimum ambient temperature during placing.

V. Ambient temperature when shotcrete sample was taken.

W. Date delivered to laboratory and date tested.

X. Submit inspection reports certification and instances of noncompliance to Resident Engineer.

3.8 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.
      g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
   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 Resident Engineer.

3.9 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 Resident Engineer.

3.10 SHEAR CONNECTOR STUDS

A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.

B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.

C. Submit inspection reports, certification, and instances of noncompliance to Resident Engineer.

END OF SECTION

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

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 Resident Engineer to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Resident Engineer and the Contracting Officer 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 Resident Engineer. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
   1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
   2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
      a. Box and protect from damage existing trees and shrubs to remain on the construction site.
      b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
      c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
   3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
   4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
      a. Reuse or conserve the collected topsoil sediment as directed by the Resident Engineer. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.
      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 Resident Engineer.

C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
   1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
   2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
   3. Monitor water areas affected by construction.

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

E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of California and California air pollution control laws and California code of regulations and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
   1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
   2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
   3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
   4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Resident Engineer. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
   1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m unless otherwise permitted by local ordinance or the Resident Engineer. Repetitive impact noise on the property shall not exceed the following dB limitations:

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

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

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

b. Use shields or other physical barriers to restrict noise transmission.
c. Provide soundproof housings or enclosures for noise producing machinery.
d. Use efficient silencers on equipment air intakes.
e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
f. Line hoppers and storage bins with sound deadening material.
g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.

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

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

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

END OF SECTION

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, at least 50% of non-hazardous waste material shall be salvaged, recycled or reused in order to comply with Executive Order 13514.

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, 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.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

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

7. Contamination.
8. Mishandling.
9. Breakage.

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

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

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

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

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

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

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

1.4 TERMINOLOGY

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.

B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.

C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.

D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).

F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.

G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.

H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.

I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

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

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

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

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

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

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

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

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

1.5 SUBMITTALS

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

B. Prepare and submit to the Resident Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
   1. Procedures to be used for debris management.
   2. Techniques to be used to minimize waste generation.
   3. Analysis of the estimated job site waste to be generated:
      a. List of each material and quantity to be salvaged, reused, recycled.
      b. List of each material and quantity proposed to be taken to a landfill.
   4. Detailed description of the Means/Methods to be used for material handling.
      a. On site: Material separation, storage, protection where applicable.
      b. Off site: Transportation means and destination. Include list of materials.

1) Description of materials to be site-separated and self-hauled to designated facilities.
2) Description of mixed materials to be collected by designated waste haulers and removed from the site.

c. The names and locations of mixed debris reuse and recycling facilities or sites.
d. The names and locations of trash disposal landfill facilities or sites.
e. Documentation that the facilities or sites are approved to receive the materials.

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

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

1.6 APPLICABLE PUBLICATIONS

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

B. U.S. Green Building Council (USGBC):
1. LEED Green Building Rating System for New Construction

1.7 RECORDS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. List of each material and quantity to be salvaged, recycled, 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.

END OF SECTION

SECTION 01 78 39.01
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Definitions:
   1. Documents required for construction: Complete set of all documents required by Contract Documents, including but not limited to:
      a. Contract Drawings.
      b. Project Manual and Specifications.
      c. Addenda.
      d. Shop Drawings.
      e. Product Data.
      f. Samples and Mock-ups.
      g. Project Information.
      h. Change Orders.
      i. Directives, Clarifications, Interpretations, etc.
      j. Field test records.
      k. Warranties.
   2. Field documents: Complete set of all documents required for construction.
      a. Used for construction of project.
      b. Contract drawings in form of prints.
   3. Periodic Update Documents: Complete separate set of all documents required for construction with exception of samples and mock-ups.
      a. Do not use for construction of project.
   4. Project Record Documents: Complete set of all documents required for construction with exception of samples and mock-ups.

1.2 SUBMITTALS

A. Contract closeout information:
   1. Copy of transmittal letter to Owner.
      a. At completion of project, turn over Project Record Documents to Owner with letter of transmittal.
      b. Submit Record Documents in containers used for Periodic Update Documents.
      c. Provide Transmittal Letter containing:
         1) Date.
         2) Project title.
         3) Contractor's name and address.
         4) Title and number of each Project Record Document.
         5) Certification that Project Record Documents submitted are complete, accurate and reflect actual construction of project.
         6) Owner's signature indicating receipt and acceptance of Project Record Documents.
   2. Copy of Record Drawing files on compact disk to Architect.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 POSTING PRIOR TO CONSTRUCTION

A. After Contract is executed, but prior to start of construction, obtain Contract Drawings and Project Manual/Specifications that will be used for Field Documents and Periodic Update Documents.

B. Obtain copies of all addenda and post all above documents.

3.2 FIELD DOCUMENTS

A. Maintain minimum of one copy at project site.

B. Label each document "FIELD."

C. These documents will be used for construction of project.

D. Make documents available at all times for review by Architect, Owner and authorities having jurisdiction.

3.3 PERIODIC UPDATE DOCUMENTS

A. Maintain one copy at project site.

B. Label each document "PERIODIC UPDATE."

C. Do not use these documents for construction purposes.

D. Make documents available at all times for review by Architect, Owner and authorities having jurisdiction.

E. Maintain in clean, dry, legible condition.

F. Maintain Contract Drawings in stackable, enclosed cardboard file drawers designed to hold drawings horizontally.
   1. Provide index of contents of each file drawer on outside of drawer.

G. Maintain all other Periodic Update Documents in stackable, enclosed file boxes designed to hold specific type of document.
   1. Provide index of contents of each box on outside of box.

3.4 POSTING AND UPDATING OF PERIODIC UPDATE DOCUMENTS

A. Post and update on weekly basis.

B. Contract drawings: Mark legibly to record actual construction including but not limited to:
   1. Depths of various elements of foundations in relation to first floor level.
   2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
   3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
   4. Field changes of dimension and detail.
   5. Changes made by change order, field order, clarifications, interpretations, directives, etc.
   6. Addenda.

C. Project Manual/Specifications: Type on each section to record all changes including but not limited to:
   1. Addenda.
   2. Change order or field order.
   3. Clarifications, interpretations, directives, etc.
   4. Bind added sections into Project Manual/Specifications.
   5. Indicate manufacturer, makes, and models used for actual construction of project.

D. Do not conceal work for which information must be recorded until all required information is recorded on Periodic Update Documents.

E. Any work concealed prior to recording of required information must be uncovered.

F. Once all required information is recorded on Periodic Update Documents, restore work at Contractor's expense.

3.5 PRODUCTION OF PROJECT RECORD DOCUMENTS

A. Utilize set of Contract Drawings.

B. Record Drawings:
   1. Clean set of Contract Drawings with Architect's seals and signatures removed shall be used for Record Drawings.
   2. Skilled draftsperson shall transfer all changes, corrections, entries, and other items from Periodic Update Documents to prints utilizing red pen.
   3. Label each document "PROJECT RECORD PRODUCED BY CONTRACTOR" and date in prominent place.
   4. Scan Record Drawings into electronic Adobe PDF file format.
      a. 300 dpi resolution.
      b. Name each PDF file to match Contract Drawing identification (i.e. "A-103G.pdf").
   5. Provide Owner original Record Drawings, and CD-R of scanned drawings in PDF file format.
   6. Provide Architect CD-R of scanned drawings in PDF file format.

END OF SECTION

SECTION 01 79 00.01
SYSTEM DEMONSTRATIONS

1.1 DESCRIPTION

A. Provide instruction for all equipment and systems for which operating and maintenance data is required.

1.2 QUALITY ASSURANCE

A. Instructors:
   1. Member of installer's staff and authorized representative of component, assembly, or system manufacturer.
   2. See specification technical sections for additional requirements.

1.3 JOB CONDITIONS

A. Complete all instruction prior to Substantial Completion.
   1. Submit separate report for each system or type of equipment, subject to Owner's approval.
      a. Submit report (form attached), with preliminary information indicated, to Owner at least 2 weeks prior to first instruction period.
      b. Submit completed report to Owner and Architect.

PART 2 - EXECUTION

2.1 PREPARATION

A. Do not begin instruction until component, assembly, or system has been tested as specified and is in correct operating condition.

B. Assemble instructional aids.

C. Have operating and maintenance data available for use during instruction.

D. Schedule all instruction with Owner.

2.2 INSTRUCTION

A. Instruct Owner's personnel in operation and maintenance of equipment and systems.

B. Provide all necessary instruction to satisfaction of Owner.

C. Explain use of operating and maintenance manuals.

D. Tour building areas involved and identify:
   1. Maintenance points and access.
   2. Control locations and equipment.

E. Explain operating sequences.
   1. Identify location and show operation of switches, valves, etc., used to start, stop and adjust systems.
   2. Explain use of flow diagrams, operating sequence diagrams, etc.
   3. Demonstrate operation through complete cycle or cycles and full range of operation in all modes, including testing and adjusting relevant to operation.

F. Explain use of control equipment, including temperature settings, switch modes, available adjustments, reading of gauges, and functions that must be serviced only by authorized factory representatives.

G. Explain trouble shooting procedures.
   1. Demonstrate common occurring problems.
   2. Note procedures which must be performed by factory personnel.

H. Explain maintenance procedures and requirements.
   1. Point out items requiring periodic maintenance.
   2. Demonstrate typical preventive maintenance procedures and recommended typical maintenance intervals.
   3. Demonstrate other commonly occurring maintenance procedures not part of preventive maintenance program.
   4. Identify maintenance materials to be used.

I. Furnish all tools required.

END OF SECTION

EQUIPMENT AND SYSTEMS OWNER INSTRUCTION REPORT

Project: _____
Project No.: _____
Contractor: _____
System or equipment: _____
Specification Section: _____

NOTE: Contractor's Representative/Construction Managers Representative maintain and complete this report during course of instruction.

PRELIMINARY INFORMATION

To be completed by Contractor/Construction Manager:
Proposed dates for instruction period: _____ to _____.
Contractor Representative conducting instruction: _____.
Number of hours of instruction required by Contract Documents: _____.

To be completed by Owner:
Owner's personnel to be instructed (designate supervisor if required).
_____
_____

INSTRUCTION LOG						
Date	**No. Hours**	**Material Covered**	**Instr. Init.**	**Owner's Personnel Receiving Instruction**	**Init.**	**Comments**

Total Hours Completed: _____ Instructor's Signature: _____

Date Instruction Completed: _____ Owner's Signature: _____

Distribution: ❑ Owner ❑ Architect ❑ Construction Manager ❑ Contractor

SECTION 01 81 11.01
SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. 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 obtain acceptable Indoor Air Quality (IAQ) for the completed project and minimize the environmental impacts of the construction and operation, the Contractor during the construction phase of this project shall implement the following procedures:
   1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce, and employ recycled and/or recyclable materials. 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 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 MANANGEMENT

B. Section 01 91 00 GENERAL COMMISSIONG REQUIREMENTS

1.4 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 is 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. 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.

2. 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, 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.
3. Irrigation Systems: Provide manufacturer's cut sheets for all permanent landscape irrigation system components .
4. 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.
5. 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).
6. 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.
7. 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
8. 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.
9. Floorcoverings:
   a. Carpet Systems: Submittals for all carpet must include the following:

      1) Manufacturer's product data verifying that all carpet systems meet or exceed the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.

10. 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 added urea-formaldehyde resins and meet CARB regulations.
11. 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

12. Mercury in Lighting: Provide manufacturer's cut sheets or product data for all fluorescent or HID lamps highlighting mercury content.
13. Lighting Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all lighting controls systems components.
14. Thermal Comfort Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all thermal comfort-control systems components.
15. Gypsum Wall Board: Provide manufacturer's cut sheets or product data verifying that all gypsum wallboard products are moisture and mold-resistant.
16. Fiberglass Insulation: Provide manufacturer's cut sheets or product data verifying that fiberglass batt insulation contains no added urea-formaldehyde.
17. 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.
18. Green Housekeeping: Provide documentation that all cleaning products and janitorial paper products meet the VOC limits and content requirements of this specification section.

B. Construction Waste Management: See Section 01 74 19 "Construction Waste Management" for submittal requirements.

C. 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 Un-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. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille
   c. 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.

D. Commissioning: See Section 01 91 00 "General Commissioning Requirements" for submittal requirements.

E. 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 Goals . The purpose of this meeting is to develop a mutual understanding of the Project’s Sustainable Design Goals 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 Goals of these specifications will be an agenda item at all regular job meetings conducted during the course of work at the site.

PART 2 - 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. Site Paving: All site impervious paving must be light colored, with a Solar Reflectance Index (SRI) of at least 29.

D. 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.

E. 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.

F. Irrigation Systems: Any permanent landscape irrigation systems must be comprised of below-grade drip emitters controlled by moisture sensors. Timer controls shall not be permitted.

G. Water-Conserving Fixtures: Plumbing fixtures and fittings shall use in aggregate at least 30% 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: Water sense rated with no more than 0.125 gallons per flush or use where considered appropriate.
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. Elimination of CFCs AND HCFCs:
1. Ozone Protection: 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.
3. Extruded polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation shall not be manufactured with hydrochlorofluorocarbon (HCFC) blowing agents.

I. HVAC Distribution Efficiency:
1. All duct systems shall be constructed of galvanized sheet metal, aluminum, or stainless steel 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, in accordance with specification section 23 31 00.
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.

J. 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. 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).
   b. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill.
   c. 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

END OF SECTION

SECTION 01 91 00
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.

B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 7, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.

C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.

D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 7, Division 8, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.

E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction, and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:
   1. Verify that the applicable equipment and systems are installed in accordance with the contact documents and according to the manufacturer's recommendations.
   2. Verify and document proper integrated performance of equipment and systems.
   3. Verify that Operations & Maintenance documentation is complete.
   4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
   5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
   6. Document the successful achievement of the commissioning objectives listed above.

F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.

1.2 CONTRACTUAL RELATIONSHIPS

A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the Resident Engineer as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer and the Resident Engineer.

B. In this structure, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Resident Engineer and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the Resident Engineer and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the Resident Engineer.

C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc) is essential to the success of the Commissioning effort.

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

1.3 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 07 08 00 FACILITY EXTERIOR CLOSURE COMMISSIONING.

C. Section 21 08 00 COMMISSIONING OF FIRE PROTECTION SYSTEMS.

D. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

E. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

F. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.

G. Section 27 08 00 COMMISSIONING OF COMMUNICATIONS SYSTEMS.

H. Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

I. Section 31 08 00 COMMISSIONING OF UTILITIES.

1.4 SUMMARY

A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.

B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

C. The commissioning activities have been developed to support the Green Buildings Initiative Green Globes rating program and to support delivery of project performance in accordance with the VA requirements developed for the project.

1.5 DEFINITIONS

A. Architect: Includes Architect identified in the Contract for Construction between the Department of Veterans Affairs and Contractor, plus consultant/design professionals responsible for design of fire suppression, plumbing, HVAC, controls for HVAC systems, electrical, communications, electronic safety and security, as well as other related systems.

B. CxA: Commissioning Agent.

C. Commissioning Plan: a document that is an overall plan that outlines the commissioning process, commissioning team responsibilities, schedule for commissioning activities, and commissioning documents.

D. Commissioning Issue: a condition in the installation or function of a component, piece of equipment or system that affects the system operations, maintenance, and/or repair.

E. Commissioning Observation: a condition in the installation or function of a component, piece of equipment or system that may not be in compliance with the Contract Documents, or may not be in compliance with the manufacturer's installation instruction, or may not be in compliance with generally accepted industry standards.

F. Systems Functional Performance Test: a test, or tests, of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems Functional Performance Testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not Systems Functional Performance Testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while System Functional Performance Testing is verifying that the system has already been set up properly and is functioning in accordance with the Construction Documents. The Commissioning Agent develops the Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents the actual testing. Systems Functional Performance Testing is performed by the Contractor. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.

G. System: A system is defined as the entire set of components, equipment, and subsystems which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one component of an entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam supply, chilled water supply, refrigerant supply, hot water supply, controls and electrical service, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of the fuel supply, combustion air, controls, steam, feedwater supply, condensate return and other related components.

H. Pre-Functional Checklist: a list of items provided by the Commissioning Agent to the Contractor that require inspection and elementary component tests conducted to verify proper installation of equipment. Pre-Functional Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some Pre-Functional Checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The term "Pre-Functional" refers to before Systems Functional Performance Testing. Pre-Functional Checklists augment and are combined with the manufacturer's startup checklist and the Contractor's Quality Control checklists.

I. Seasonal Functional Performance Testing: a test or tests that are deferred until the system will experience conditions closer to their design conditions.

J. VA: Includes the Contracting Officer, Resident Engineer, or other authorized representative of the Department of Veterans Affairs.

K. TAB: Testing, Adjusting, and Balancing.

1.6 SYSTEMS TO BE COMMISSIONED

A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.

B. The following systems will be commissioned as part of this project:

1. Facility exterior closure (Division 7 and Division 8)
    a. Roofs (Built-up bituminous, modified bituminous, flashing & sheet metal, roof specialties, and roof accessories)
    b. Curtain Wall Systems (Mullions, glazing, and sealing)
    c. Exterior Doors (Glass leaf, emergency exit, and service)
    d. Exterior Windows (Aluminum, steel, glazing)
    e. Louvers and Vents
    f. Sealants (Caulking, mechanical seals, and wind and vapor barriers)
2. Fire Suppression (Division 21)
    a. Fire Protection System (Fire pump, jockey pump, fire pump automatic transfer switch/controller, Wet-pipe fire suppression, Dry-pipe fire suppression, Pre-action fire suppression, dry system air compressors and motors, and clean agent fire suppression).
3. Plumbing (Division 22)
    a. Domestic Hot Water systems (Domestic water heaters, steam-to-hot water converters, hot water circulating pumps and motors, controls).
    b. Laboratory Gas systems (Compressed air and air compressor, carbon dioxide, Gas Alarm System).
    c. Emergency Plumbing Fixtures (Showers, eye wash stations, water tempering valves, instruments and gages).
4. HVAC (Division 23)
    a. Air handling systems (including supply air terminal units and air valves).
    b. Air Handling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).
    b. Heating Hot Water Systems (Converters, controls, instrumentation and gages, flues, heating water pumps and motors, Variable Speed Drives, mixing valves).
    c. Condensate Return Systems (Condensate receivers and transfer pumps, motors, controls, pump alternator, alarms and instrumentation, and motors, safeties).
    d. Chilled Water Systems (Chilled water pumps and motors, Variable Speed Drives, chiller motor/compressor, controls, instrumentation and safeties, isolation valves, blending valves, side stream water cleaners/scrubbers/filters).
    e. Exhaust Fans (Fan, motor, Exhaust Air Valves outside air by-pass dampers, controls and safeties).
    f. Steam System (Boilers, controls, gages and instrumentation, safety relief valves, combustion burners/fans/motors, fuel delivery pumps and motors, flues).
    g. Direct Digital Control System (BACnet or similar Local Area Network (LAN), Operator Work Station hardware and software, building controller hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time).
    h. Laboratory Ventilation Systems (Supply air terminal units and controls, pressure controls and alarms, fans, motors, and Variable Speed Drives).
    i. Room Pressurization Equipment (Pressure sensors, terminal units/dampers, and controls and alarms).
    j. HVAC Water Treatment Systems (Closed circuits – including shot feeders and final water analysis).
    k. Animal Drinking Water System
5. Electrical (Division 26)
    a. Utility Service Entrance Switchgear (Fuses and circuit breaker settings, metering, mimic diagram, gages, and controls).
    b. Standby Generator Systems (Automatic transfer switches,).
    c. Automatic Transfer Switches (Test with associated generator).

d. Normal Power Distribution Systems (Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
e. Life Safety Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
f. Essential Equipment Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
g. Lighting Controls (Control system hardware and software, scene settings, zone settings, occupancy sensor interface, and unoccupied cycle control).
h. Uninterruptible Power Supply Systems and UPS Power Distribution Systems (Battery chargers, static and dynamic power generators – i.e. inverters, MG sets, metering and controls, system power displays, and distribution panel circuit breakers).

6. Communications (Division 27)
   a. Facility Telecommunications and Data Distribution Systems.
   b. Nurse Call / Code Blue Systems (Local stations, system hardware and software, reset functions, response time per activation, and notification signals).
   c. Public Address and Mass Notification Systems (Amplifiers and head-end hardware, speaker volume, and background noise – i.e. hiss or similar interference).
   d. Healthcare Intercommunications and Program Systems (Local stations, system hardware and software, and notification signals).
7. Electronic Safety and Security (Division 28)
   a. Fire Detection and Alarm (Master panel and software, addressable units – i.e. pull stations, flow detectors, hear detectors, etc., controls and alarm functions, horns/bells/door releases and other output devices, and fire command center functions – stairwell communications, stairwell pressurization fan start, mechanical systems shutdowns).
8. Site Utility Systems (Division 31)
   a. Sanitary Sewage Lift Stations (Lift station sump or tank level controls, pump alternator, alarms and alarm panel, pumps and motors).
   b. Steam Condensate Pump Stations (Condensate receivers and transfer pumps, motors, controls, pump alternator, alarms and instrumentation, and safeties).
   c. Storm Drainage Pump Systems (Sump level controls, pump alternator, alarms and alarm panel, pumps and motors).

1.7 COMMISSIONING TEAM

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

B. Members Appointed by VA:
   1. Representatives of the facility user and operation and maintenance personnel.
   2. Architect and engineering design professionals.

1.8 VA'S COMMISSIONING RESPONSIBILITIES

A. Appoint an individual, company or firm to act as the Commissioning Agent.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
   1. Coordination meetings.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Testing meetings.
   4. Witness and assist in Systems Functional Performance Testing.
   5. Demonstration of operation of systems, subsystems, and equipment.

C. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

1.9 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

A. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.

B. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.

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

1.10 COMMISSIONING AGENT’S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.

C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.

D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.

E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.

F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.

G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.

H. Coordinate Systems Functional Performance Testing schedule with the Contractor.

I. Witness selected systems startups.

J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.

K. Witness and document Systems Functional Performance Testing.

L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.

M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.

N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.

O. Prepare commissioning Field Observation Reports.

P. Prepare the Final Commissioning Report.

Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

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

1.11 COMMISSIONING DOCUMENTATION

A. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:
   1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
   2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
   3. Identification of systems and equipment to be commissioned.
   4. Schedule of Commissioning Coordination meetings.
   5. Identification of items that must be completed before the next operation can proceed.
   6. Description of responsibilities of commissioning team members.
   7. Description of observations to be made.
   8. Description of requirements for operation and maintenance training.
   9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
   10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
   11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
   12. Preliminary Systems Functional Performance Test procedures.

B. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:
   1. Name and identification code of tested system.
   2. Test number.
   3. Time and date of test.
   4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
   5. Dated signatures of the person performing test and of the witness, if applicable.
   6. Individuals present for test.
   7. Observations and Issues.
   8. Issue number, if any, generated as the result of test.

C. Pre-Functional Checklists: The Commissioning Agent will prepare Pre-*Functional Checklists. Pre-Functional Checklists shall be completed* and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.

D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.

F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.
   1. Creating an Commissioning Issues Log Entry:
      a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
      b. Assign a descriptive title for the issue.
      c. Identify date and time of the issue.
      d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
      e. Identify system, subsystem, and equipment to which the issue applies.
      f. Identify location of system, subsystem, and equipment.
      g. Include information that may be helpful in diagnosing or evaluating the issue.
      h. Note recommended corrective action.
      i. Identify commissioning team member responsible for corrective action.
      j. Identify expected date of correction.
      k. Identify person that identified the issue.
   2. Documenting Issue Resolution:
      a. Log date correction is completed or the issue is resolved.
      b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
      c. Identify changes to the Contract Documents that may require action.
      d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
      e. Identify person(s) who corrected or resolved the issue.
      f. Identify person(s) verifying the issue resolution.

G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
2. Commissioning plan.
3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
5. Commissioning Issues Log.
6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.

H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:
1. Documentation of deferred and off season test(s) results.
2. Completed Systems Functional Performance Test Procedures for off season test(s).
3. Documentation that unresolved system performance issues have been resolved.
4. Updated Commissioning Issues Log, including status of unresolved issues.
5. Identification of potential Warranty Claims to be corrected by the Contractor.

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

1.12 SUBMITTALS

A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:
1. The Commissioning Team: A list of commissioning team members by organization.
2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.

6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.

B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.

C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.

D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.

E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.

F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA Resident Engineer with copies to the Contractor and Architect.

G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.

H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.

I. Data for Commissioning:
1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

1.13 COMMISSIONING PROCESS

A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.

B. Within 30 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.

C. Within 60 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

1.14 QUALITY ASSURANCE

A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.

B. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.15 COORDINATION

A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

B. Scheduling: The Contractor will work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.

C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.

D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.

F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.

B. Data logging equipment and software required to test equipment shall be provided by the Contractor.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 ^{o}C (1.0 ^{o}F) and a resolution of + or - 0.1 ^{o}C (0.2 ^{o}F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS

A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.
   1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.
      a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
      b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.
   2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.
      a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.

b. The full startup plan shall at a minimum consist of the following items:
   1) The Pre-Functional Checklists.
   2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
   3) The manufacturer's normally used field checkout sheets.
      a) The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.
      b) The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.

3. Sensor and Actuator Calibration
   a. All field installed temperature, relative humidity, CO_2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 specifications.
   b. All procedures used shall be fully documented on the Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
4. Execution of Equipment Startup
   a. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
   b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
   c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
   d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

3.2 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP

A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.

B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.

C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

3.3 PHASED COMMISSIONING

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

3.4 TRENDING AND ALARMS

A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.

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

C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.

D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the Resident Engineer and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:
   1. <u>Pre-testing, Testing, and Post-testing</u> – Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the Resident Engineer. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the Resident Engineer, prior to the execution of Systems Functional Performance Testing.

2. Dynamic plotting – The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.
3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If this cannot be sufficiently accomplished directly in the Direct Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.
4. The following tables indicate the points to be trended and alarmed by system and points shall be measured for each unit. The Operational Trend Duration column indicates the trend duration for normal operations. The Testing Trend Duration column indicates the trend duration prior to Systems Functional Performance Testing and again after Systems Functional Performance Testing. The Type column indicates point type: AI = Analog Input, AO = Analog Output, DI = Digital Input, DO = Digital Output, Calc = Calculated Point. In the Trend Interval Column, COV = Change of Value. The Alarm Type indicates the alarm priority; C = Critical, P = Priority, and M = Maintenance. The Alarm Range column indicates when the point is considered in the alarm state. The Alarm Delay column indicates the length of time the point must remain in an alarm state before the alarm is recorded in the DDC. The intent is to allow minor, short-duration events to be corrected by the DDC system prior to recording an alarm.

Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
OA Temperature	AI	15 Min	24 hours	3 days	N/A		
SA Temp	AI	15 Min	24 hours	3 days	C	±5°F from SP	10 min
Supply Fan Speed	AI	15 Min	24 hours	3 days	N/A		
OA Pre-Filter Status	AI	None	None	None	N/A		
After Filter Status	AI	None	None	None	N/A		
SA Flow	AI	15 Min	24 hours	3 days	C	±10% from SP	10 min
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
High Static Status	DI	COV	24 hours	3 days	P	True	1 min
Fire Alarm Status	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 1	DI	COV	24 hours	3 days	C	True	10 min
Freeze Stat Level 2	DI	COV	24 hours	3 days	C	True	5 min
Exhaust Fan #1 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min

Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Exhaust Fan #2 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #3 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #4 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #5 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
High Static Alarm	DI	COV	24 hours	3 days	C	True	10 min
Supply Fan Speed	AO	15 Min	24 hours	3 days	N/A		
AHU CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
AHU HW Valve Position	AO	15 Min	24 hours	3 days	N/A		
Supply Fan S/S	DO	COV	24 hours	3 days	N/A		
Fire/Smoke Dampers	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
AHU Energy	Calc	1 Hour	30 day	N/A	N/A		

Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Air Flow	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Local Setpoint	AI	15 Min	12 hours	3 days	M	±10°F from SP	60 min
Unoccupied Override	DI	COV	12 hours	3 days	M	N/A	12 Hours
Damper Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		

2-Pipe Fan Coil Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Cooling Coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Fan Coil ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

Hydronic Hot Water Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
System HWS Temperature	AI	15 min	12 hours	3 days	C	±5°F from SP	10 Min
System HWR Temperature	AI	15 min	12 hours	3 days	M	±15°F from SP	300 Min
System Flow (GPM)	AI	15 min	12 hours	3 days	N/A		
System Differential Pressure	AI	15 min	12 hours	3 days	P	±10% from SP	8 Min
HW Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 1 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 2 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HW Pump 2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HWR #1 Valve	DO	COV	12 Hours	3 days	N/A		

Hydronic Hot Water Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
HWR #2 Valve	DO	COV	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Chiller Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Chiller Enable	DO	COV	12 Hours	3 days	N/A		

E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified after submission shall be recorded and resubmitted to the Resident Engineer and Commissioning Agent.
   1. Point-to-Point checkout documentation;
   2. Sensor field calibration documentation including system name, sensor/point name, measured value, DDC value, and Correction Factor.
   3. A sensor calibration table listing the referencing the location of procedures to following in the O&M manuals, and the frequency at which calibration should be performed for all sensors, separated by system, subsystem, and type. The calibration requirements shall be submitted both in the O&M manuals and separately in a standalone document containing all sensors for inclusion in the commissioning documentation. The following table is a sample that can be used as a template for submission.

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

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

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

3.5 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.

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

C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.

D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms developed by the Commissioning Agent will include, but not be limited to, the following information:
   1. System and equipment or component name(s)
   2. Equipment location and ID number
   3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment.
   4. Date
   5. Project name
   6. Participating parties
   7. A copy of the specification section describing the test requirements
   8. A copy of the specific sequence of operations or other specified parameters being verified
   9. Formulas used in any calculations
   10. Required pretest field measurements
   11. Instructions for setting up the test.
   12. Special cautions, alarm limits, etc.
   13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
   14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
   15. A section for comments.
   16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.

E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.
   1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.

2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.
5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.

F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.

G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.

H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.

J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems will be checked.

K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

3.6 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS

A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.

B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.

1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.
2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.
4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
   a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will submit a Commissioning Field Report to the VA. The Commissioning Agent will also note items of noncompliance and the Contractor’s response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.
   b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.
5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:
   a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor’s response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.

b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.
c. The Commissioning Agent will document the resolution process.
d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.

C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:
1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be made later after review by the Commissioning Agent and by the VA. The Commissioning Agent will evaluate each test and report to the VA using a standard form. The VA will give final approval on each test using the same form, and provide signed copies to the Commissioning Agent and the Contractor.

3.7 DEFERRED TESTING

A. Unforeseen Deferred Systems Functional Performance Tests: If any Systems Functional Performance Test cannot be completed due to the building structure, required occupancy condition or other conditions, execution of the Systems Functional Performance Testing may be delayed upon approval of the VA. These Systems Functional Performance Tests shall be conducted in the same manner as the seasonal tests as soon as possible. Services of the Contractor to conduct these unforeseen Deferred Systems Functional Performance Tests shall be negotiated between the VA and the Contractor.

B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for Deferred Seasonal Testing. The VA will review and approve the schedule for Deferred Seasonal Testing. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications.

3.8 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's Resident Engineer, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.

B. The Contractor shall provide training and demonstration as required by other Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 sections. The Training and Demonstration shall include, but is not limited to, the following:
   1. Review the Contract Documents.
   2. Review installed systems, subsystems, and equipment.
   3. Review instructor qualifications.
   4. Review instructional methods and procedures.
   5. Review training module outlines and contents.
   6. Review course materials (including operation and maintenance manuals).
   7. Review and discuss locations and other facilities required for instruction.
   8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
   9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:
   1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.
   2. Qualification Data: Submit qualifications for facilitator and/or instructor.
   3. Attendance Record: For each training module, submit list of participants and length of instruction time.
   4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
   5. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.
      a. Identification: On each copy, provide an applied label with the following information:
         1) Name of Project.
         2) Name and address of photographer
         3) Name of Contractor.
         4) Date videotape was recorded.
         5) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

D. QUALITY ASSURANCE
1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
3. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

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

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

G. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:
      a. Emergency manuals.
      b. Operations manuals.
      c. Maintenance manuals.
      d. Project Record Documents.
      e. Identification systems.
      f. Warranties and bonds.
      g. Maintenance service agreements and similar continuing commitments.
   3. Emergencies: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Instructions on stopping.
      c. Shutdown instructions for each type of emergency.
      d. Operating instructions for conditions outside of normal operating limits.
      e. Sequences for electric or electronic systems.
      f. Special operating instructions and procedures.
   4. Operations: Include the following, as applicable:
      a. Startup procedures.
      b. Equipment or system break-in procedures.
      c. Routine and normal operating instructions.
      d. Regulation and control procedures.
      e. Control sequences.
      f. Safety procedures.
      g. Instructions on stopping.
      h. Normal shutdown instructions.
      i. Operating procedures for emergencies.
      j. Operating procedures for system, subsystem, or equipment failure.
      k. Seasonal and weekend operating instructions.
      l. Required sequences for electric or electronic systems.
      m. Special operating instructions and procedures.
   5. Adjustments: Include the following:
      a. Alignments.
      b. Checking adjustments.
      c. Noise and vibration adjustments.
      d. Economy and efficiency adjustments.
   6. Troubleshooting: Include the following:
      a. Diagnostic instructions.
      b. Test and inspection procedures.
   7. Maintenance: Include the following:
      a. Inspection procedures.
      b. Types of cleaning agents to be used and methods of cleaning.
      c. List of cleaning agents and methods of cleaning detrimental to product.

d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

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

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

I. Demonstration and Training Recording:
1. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
2. Video Format: Provide high quality color DVD color on standard size DVD disks.
3. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
4. Narration: Describe scenes on videotape by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

END OF SECTION

SECTION 02 21 00
SITE SURVEYS

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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.

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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 underground utility, 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.

G. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.8, INFECTION PREVENTION MEASURES.

H. Asbestos and Lead Survey Report: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.1, GENERAL INTENTION..

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. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. 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.

F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
   1. No wall or part of wall shall be permitted to fall outwardly from structures.
   2. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
   3. 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.
   4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center any damaged items shall be repaired or replaced as approved by the Resident Engineer. 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 Resident Engineer's approval.

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

I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.8 INFECTION PREVENTION MEASURES.

1.4 UTILITY SERVICES:

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

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

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 DEMOLITION:

A. Completely demolish and remove 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 in a legal manner by him/her 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 Resident Engineer. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

C. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of first and second stories may proceed simultaneously.

D. 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.

E. 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 Resident Engineer. When Utility lines are encountered that are not indicated on the drawings, the Resident Engineer shall be notified prior to further work in that area.

3.2 **CLEAN-UP:**

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

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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 03, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN

A. Testing agency retained and reimbursed by the Owner see 01 45 29 and approved by Resident Engineer.

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. Construct formwork so concrete surfaces will conform to tolerance limits of ACI 117 or as listed: Tolerances non-cumulative. Most restrictive tolerance governs. Tolerance limits noted are maximum deviations (plus or minus) on each side of intended line.
   1. Deviation from plumb:
      a. In lines and surfaces of columns, piers, walls, and in arrises:
         1) In any length: 1 in 500 but not less than 1/8 inch.
         2) In any story: 3/8 inch.
         3) Maximum for entire length: 3/4 inch.
      b. For exposed corner columns, control-joint grooves, and other conspicuous vertical lines:
         1) In any length: 1 in 1000 but not less than 1/8 inch.
         2) In any story: 3/16 inch.
         3) Maximum for entire length: 1/2 inch.
   2. Deviation from level or from grades specified:
      a. In slab soffits, ceilings, beam soffits and in arrises, measured before removal of supporting shores:
         1) In any length: 1 in 750 but not less than 1/8 inch.
         2) In any bay: 3/8 inch.
         3) Maximum for entire length: 1/2 inch.
      b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous horizontal lines:

1) In any length: 1 in 1000, but not less than 1/8 inch.
2) In any bay: 1/4 inch.
3) Maximum for entire length: 1/2 inch.

3. Deviations from true plane of concrete surface exposed to view caused by bulging of form facing material between supports:
   a. 3/16 inch or l/300 of span between supports whichever is smaller.
4. Deviation from established position in plan of linear building lines, columns, walls:
   a. In any length: 1 in 500, but not less than 1/8 inch.
   b. In any bay: 1/2 inch.
   c. Maximum for entire length: 3/4 inch.
5. Deviation in sizes and location of sleeves, floor openings, and wall openings: 1/4 inch.
6. Deviation in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:
   a. Minus: 1/4 inch.
   b. Plus: 1/2 inch.
7. Footings:
   a. Deviations in dimensions in plan:
      1) Minus: 1/2 inch.
      2) Plus: 2 inches.
   b. Misplacement or eccentricity:
      1) 2 percent of footing width in direction of misplacement but not more than 2 inches.
   c. Thickness:
      1) Decrease in specified thickness: 5 percent.
      2) Increase in specified thickness: No limit (except that which may interfere with other construction).
8. Deviation in steps:
   a. In flight of stairs:
      1) Rise: 1/8 inch.
      2) Tread: 1/4 inch.
   b. In consecutive steps:
      1) Rise: 1/16 inch.
      2) Tread: 1/8 inch.
   c. Deviation from level for any step or landing: 1 in 1000 but not more than 1/8 inch.

B. Formwork Classifications:
   1. Concrete formwork shall meet the following classification requirements:
      a. Concrete noted as “Architectural Exposed Concrete": Class A.
      b. Concrete exposed to view or to receive membrane waterproofing: Class B.
      c. Footings: Class D.
      d. All other concrete: Class C.

C. Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items, except where specifically noted otherwise.

D. Establish and maintain in undisturbed condition and until final completion of project, sufficient control points and bench marks to be used for reference purposes to check tolerances.

E. Regardless of tolerances listed allow no portion of building to extend beyond property [setback] line of project.

F. Reinforcement Fabricating and Placing: ACI 117 or as listed below whichever is more stringent, 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.
   1. Clear distance to formed surfaces: Plus or minus 1/4 inch.
   2. Minimum spacing between bars: Minus 1/4 inch.
   3. Top bars in slabs and beams:
      a. Members 8 inches deep or less: Plus or minus 1/4 inch.
      b. Members between 8 and 24 inches deep: Plus/minus 1/2 inch.
      c. Members more than 2 feet deep: Plus or minus 1 inch.
   4. Crosswise of members: Spaced evenly within 2 inches.
   5. Lengthwise of members: Plus or minus 2 inches.

G. 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).

H. 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. Mix Designs, stamped and signed by Civil or Structural Engineer registered in State of California. In addition to standard information mix designs shall clearly indicate the following
   1. Intended purpose of mix in correlation with project
      a. Retaining walls
      b. Perimeter walls
      c. Foundations
      d. Slab on Grade
      e. Etc.
   2. Admixtures

D. Mill Test Reports:
   1. Reinforcing Steel.
   2. Cement.

E. Manufacturer's Certificates:
   1. Abrasive aggregate.

2. Lightweight aggregate for structural concrete.
3. Air-entraining admixture.
4. Chemical admixtures, including chloride ion content.
5. Waterproof paper for curing concrete.
6. Liquid membrane-forming compounds for curing concrete.
7. Non-shrinking grout.
8. Liquid hardener.
9. Waterstops.
10. Expansion joint filler.
11. Adhesive binder.

F. 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.

G. Test Report for Concrete Mix Designs: Trial mixes including water-cement - fly ash ratio curves, concrete mix ingredients, shrinkage testing and admixtures.

H. Shoring and Reshoring Sequence: Submit for approval a shoring and reshoring sequence for flat slab/flat plate portions, prepared by a registered Professional Engineer. As a minimum, include timing of form stripping, reshoring, number of floors to be re-shored and timing of re-shore removal to serve as an initial outline of procedures subject to modification as construction progresses. Submit revisions to sequence, whether initiated by Resident Engineer (see FORMWORK) or Contractor.

I. Test reports on splitting tensile strength (Fct) of lightweight concrete.

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 and fly ash 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; lightweight aggregate manufacturer; admixture manufacturers; Resident Engineer; Consulting Engineer; Department of Veterans Affairs 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 MOCK-UP

A. In addition to the other specified samples and tests, construct a mock-up using the materials, reinforcing, forming system and construction methods proposed for use in exposed architectural concrete. The mock-up may be integral to the structure at a location such as the retaining wall along gridline one, between grids A and B.

B. Construct the mock-up with at least a 2.5 m by 2.5 m (8 feet by 8 feet) exposed surface and suitable foundations. Include the following where applicable: Control joints, reglets, recesses or other typical architectural details.

C. Before casting the mock-up, submit full detailed Shop Drawings of the mock-up formwork for review by the Architect. Perform all necessary preliminary tests to ensure that concrete used for the mock-up will exactly match the approved sample in color and texture.

D. Perform the surface treatment proposed for use on one or more areas not less than 300 mm by 300 mm (1 foot by 1 foot) on the back side of the mock-up to establish the texture of finish required by the Architect. Repeat as required until a sample satisfactory to the Architect has been obtained.

E. Treat the finished front surface of the mock-up to produce a uniform appearance similar in every respect to the approved sample area.

F. The completed mock-up shall be inspected by the Architect. Failure of the mock-up to match the approved sample will require the construction of further mock-ups until approval is obtained. Remove rejected mock-ups immediately.

G. Maintain the approved mock-ups in good condition at the job site until all architectural concrete surfaces have been completed and approved by the Architect. Remove the mock-up from the site after completion of the above, unless mock-up is approved to be integral to the structure.

1.10 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):

117-06	Tolerances for Concrete Construction and Materials
211.1-02	Selecting Proportions for Normal, Heavyweight, and Mass Concrete
211.2-04	Selecting Proportions for Structural Lightweight Concrete
214R-02	Evaluation of Strength Test Results of Concrete
301-05	Structural Concrete
304R-2000	Guide for Measuring, Mixing, Transporting, and Placing Concrete
305R-06	Hot Weather Concreting
306R-(2002)	Cold Weather Concreting
308R-(2001)	Standard Practice for Curing Concrete
309R-05	Guide for Consolidation of Concrete
31808	Building Code Requirements for Reinforced Concrete and Commentary
347R-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	Steel Wire, Plain, for Concrete Reinforcement
A185/185M-07	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
A615/A615M-08	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A653/A653M-07	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A706/A706M-06	Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A767/A767M-05	Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
A775/A775M-07	Epoxy-Coated Reinforcing Steel Bars
A820-06	Steel Fibers for Fiber-Reinforced Concrete
A996/A996M-06	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
C31/C31M-08	Making and Curing Concrete Test Specimens in the field
C33-07	Concrete Aggregates
C39/C39M-05	Compressive Strength of Cylindrical Concrete Specimens
C94/C94M-07	Ready-Mixed Concrete
C143/C143M-05	Slump of Hydraulic Cement Concrete
C150-07	Portland Cement
C157	Standard Test Method for length change of hydraulic-cement
C171-07	Sheet Materials for Curing Concrete
C172-07	Sampling Freshly Mixed Concrete
C173-07...	Air Content of Freshly Mixed Concrete by the Volumetric Method
C192/C192M-07	Making and Curing Concrete Test Specimens in the Laboratory
C231-08	Air Content of Freshly Mixed Concrete by the Pressure Method
C260-06	Air-Entraining Admixtures for Concrete
C309-07	Liquid Membrane-Forming Compounds for Curing Concrete
C330-05	Lightweight Aggregates for Structural Concrete
C494/C494M-08	Chemical Admixtures for Concrete
C496-06	Splitting Tensile Strength of Cylindrical Concrete Specimens
C567-05	Density of Structural Lightweight Concrete
C618-08	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C666/C666M-03	Resistance of Concrete to Rapid Freezing and Thawing
C881/C881M-02	Epoxy-Resin-Base Bonding Systems for Concrete
C1107/1107M-07	Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
C1315-08	Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
D6-95(R2006)	Loss on Heating of Oil and Asphaltic Compounds
D297-93(R2006)	Rubber Products-Chemical Analysis
D1751-04	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
D4397-02	Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
E1155-96(R2008)	Determining FF Floor Flatness and FL Floor Levelness Numbers

E. American Welding Society (AWS):
D1.4-05 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) at architecturally exposed concrete
   2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick at concrete to be covered by grade or by furring.
   3. Plastic, fiberglass, or elastomeric capable of reproducing the desired smooth texture desired for architectural concrete may be submitted for approval by architect and resident engineer.

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 may 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. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.

E. 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 µm (No. 100) sieve.

F. Mixing Water: Fresh, clean, and potable.

G. 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 must 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. Microsilica: Use only with prior review and acceptance of the Resident Engineer. Use only in conjunction with high range water reducer.
   7. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
   8. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.

H. Vapor Barrier: ASTM D4397, 0.25 mm (10 mil).

I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.

J. Welded Wire Fabric: ASTM A185.

K. Reinforcing Bars to be Welded: ASTM A706.

L. Galvanized Reinforcing Bars: ASTM A767.

M. Epoxy Coated Reinforcing Bars: ASTM A775.

N. Cold Drawn Steel Wire: ASTM A82.

O. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m^2 (1.5 pounds per square yard), or square mesh at .6Kg/m^2 (1.17 pounds per square yard).

P. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.

Q. Expansion Joint Filler: ASTM D1751.

R. Sheet Materials for Curing Concrete: ASTM C171.

S. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.

T. Abrasive Aggregate: Aluminum oxide grains or emery grits.

U. Liquid Hardener and Dustproofer: Fluosilicate solution of magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer.

V. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous siliconate solution concrete surface treatment applied the day of the concrete pour in lieu of other curing methods for all concrete slabs receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays .

W. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34% solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.

X. MVE 15-Year Warranty: When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer's instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a period of fifteen (15) years from the date of original installation. The warranty shall cover all labor and materials needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.

Y. 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.

Z. 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.

AA. Adhesive Binder: ASTM C881.
   1. Polyvinyl Chloride Waterstop: CRD C572.
   2. Rubber Waterstops: CRD C513.
   3. Bentonite Water Stop: 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. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).
   5. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m^3 (1.5 lb. per cubic yard). Product shall have a UL rating.
   6. Steel Fibers: ASTM A820, Type I cold drawn, high tensile steel wire for use as primary reinforcing in slab-on-grade. Minimum dosage rate 18 kg/m^3 (30 lb. per cubic yard).

7. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
8. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.
9. 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. Mix designs shall be stamped and signed by a licensed Civil or Structural engineer registered in the state of California.
   2. Each mix design shall clearly indicate the intended use of the mix. For example concrete to be used for architectural exposed concrete shear walls, shall be boldly titled “5 KSI, Architectural exposed walls.” Mixes may not be used for other purposes unless approved by resident engineer.
   3. 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.
   4. 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 m^3 (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. include dry unit weight of lightweight structural concrete.
   5. Shrinkage testing shall be performed for perimeter walls and retaining walls. Shrinkage shall not exceed 0.05% per ASTM C157 for mix designs intended for architectural walls.
   6. 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.
   7. If the field experience method is used, submit complete standard deviation analysis.

B. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Resident Engineer or as specified. Making and testing of preliminary test cylinders may 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. Resident Engineer may 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.

C. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Fly ash may be substituted for up to 20 percent of the minimum cement factor at option of Contractor, except fly ash may not be used in concrete designated as architectural concrete, or in concrete on the interior of the building such as slabs or walls (fly ash in below grade foundation is acceptable).

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

	Concrete Strength		Non-Air-Entrained
USE	Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m^3 (lbs/c. yd)	Max. Water Cement Ratio
Building Walls	35 (5000)[1,3,6]	375 (630)	0.45
Retaining walls, S.O.G.	30 (4000)[1,3,7]	325 (550)	0.55

Foundations	30 (4000)[1,3,5]	325 (550)	0.6
Lt. Wt. Slab on Deck (115 PCF)	27.5(3500)[1,2,7]	*	0.50
Miscellaneous	25 (3000)[1,3,7]	280 (470)	0.65

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. Lightweight Structural Concrete. Pump mixes may require higher cement values.
3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
4. * Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.
5. Aggregate gradation shall include max aggregate size of 1-1/2"
6. Aggregate gradation shall include max aggregate size of 1"
7. Aggregate gradation shall include max aggregate size of 3/4"

D. 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)

E. *Slump may 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 may 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 should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

F. 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.

G. Lightweight structural concrete shall not weigh more than air-dry unit weight of 115 PCF. Air-dry unit weight determined on 150 mm by 300 mm (6 inch by 12 inch) test cylinders after seven days standard moist curing followed by 21 days drying at 23 degrees C ± 1.7 degrees C (73.4 ± 3 degrees Fahrenheit), and 50 (plus or minus 7) percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.

H. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

I. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may 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, Resident Engineer may 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, Resident Engineer may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure. Any structural analysis required due to low concrete strengths shall be conducted at contractors expense.
   4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, Resident Engineer may 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 Resident Engineer.

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 must be approved by Resident Engineer. 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 38^0C (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 Resident Engineer for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will 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 Resident Engineer.

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. Formwork Engineer must be licensed in California and have at least 5 similar projects in the past 5 years. Layout and measurement of concrete forms and embedment's required for work shall be performed by a licensed surveyor employed by the contractor.
   1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Resident Engineer approves their reuse. Form liners may not be reused for architectural concrete.
   2. Provide forms for concrete footings unless Resident Engineer 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. Make forms sufficiently tight to prevent loss of cement fines. Place chamfer strips in outside corners of forms to produce 45 degree beveled corners on permanently exposed surfaces. Interior corners on such surfaces and edges of formed joints will not require beveling.

C. To maintain specified finish tolerances, camber formwork to compensate for anticipated formwork deflections prior to hardening of concrete.

D. Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.

E. At construction joints, contact surface of form sheathing for flush surfaces exposed to view shall overlap hardened concrete in previous placement minimum 1 inch. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface.

F. Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling.

G. Fasten wedges (used for final adjustment of forms prior to concrete placement) in position after final check.

H. Anchor formwork to shores or other supporting surfaces or members so upward or lateral movement of any part of formwork system is prevented during concrete placement.

I. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.

J. 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.

K. 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 or deflection requirements for tolerances set out in section 1.4.

L. 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.

M. Lined Forms: May be used in lieu of unlined plywood forms, and are required at architecturally exposed concrete. 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 may 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 to be 3d blued shingle or similar nails with thin flatheads.

N. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.

O. 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.

P. 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. 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 Resident Engineer. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the Resident Engineer, 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.

Q. 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 are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

R. Clean form surfaces and embedded materials of mortar, grout and foreign material before concrete is placed.

S. Unless otherwise specified or approved, treat surfaces of forms as follows:

1. Before placing of reinforcing steel or concrete, cover surfaces of forms with coating material that will effectively prevent absorption of moisture and prevent bond with concrete, and not stain concrete. A field applied form release agent or sealer or factory applied non-absorptive liner may be used.
2. Do not allow excess form coating material to stand in puddles in forms nor in contact with hardened concrete against which fresh concrete is to be placed.

3.2 PLACING REINFORCEMENT:

A. General: Details of concrete reinforcement in accordance with ACI 318 and ACI 315, 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. 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 will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 315. 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 will 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 Wall steel at no points other than at footings and floor levels unless otherwise shown.

C. Spacing: Minimum clear distances between parallel bars, 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. Provide minimum concrete covering for reinforcement as follows:
   1. Concrete deposited against earth: 3 inches.
   2. Formed surfaces exposed to weather or in contact with earth: 2 inch for reinforcing bars No.6 or larger; 1-1/2 inch for reinforcing bars less than No.6.
   3. Interior surfaces: 1-1/2 inch for beams,; 3/4 inch for slabs, walls

E. Splicing: Splices of reinforcement made only as required or shown or specified. Splicing not specifically indicated in drawings shall be subject to approval. 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. 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. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by Resident Engineer.
      d. Unless permitted by resident engineer do not tack weld reinforcing.

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 Resident Engineer, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will 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. Department of Veterans Affairs retained testing laboratory will perform the load test.

F. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by Resident Engineer.

G. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.

H. 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 MOISTURE VAPOR EMISSIONS & ALKALINITY CONTROL SEALER:

A. Sealer is applied on the day of the concrete pour or as 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, carpet, epoxy coatings and overlays.

B. Manufacturer's representative will 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.
   1. 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.
   2. Spray apply Sealer at the rate of 20 m^2 (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
   3. 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 Resident Engineer.

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. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

3.6 CONTROL JOINTS

A. Contractor shall submit a proposed control joint layout for all horizontal surfaces, (slab on grade, elevated slab and floating slab) prior to concrete pour for review by Architect and Engineer.

B. Slab on grade Control joints shall be saw cut or formed. Control joints shall be placed to control cracking at columns, changes in slab thickness, corners of equipment pads and punch outs. Slabs to receive flooring, sloped topping slab or epoxy coating shall have control joints filled with flexible epoxy filler. Manufacturer shall supply certification of filler compatibility with flooring.

C. On elevated slabs, control joinst shall be places at column lines, to a max depth of ¾” inch. Flexible epoxy filler shall be supplied as in section 3.6A.

D. The floating slab on structural insulation shall receive control joints at all columns lines, equipment pads, centered on the length of multiple pipe penetrations, and on 15’-0” o.c. max.

3.7 EXPANSION JOINTS

A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

B. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

3.8 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 Resident Engineer 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 will prevent segregation. Method of conveying concrete subject to approval of Resident Engineer.

D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD 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 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) 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.
   4. 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.
   5. 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 will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
   6. 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 may be a continuation of this concrete or concrete with a conventional slump.
   7. 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. At architecturally exposed concrete self consolidating concrete admixture shall be used.

3.9 HOT WEATHER

A. 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 Resident Engineer.

3.10 COLD WEATHER

A. Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyantes or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

3.11 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 may be used if approved by Resident Engineer.
   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 $10m^2/L$ (400 square feet per gallon) on steel troweled surfaces and $7.5m^2/L$ (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.

3.12 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 may 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. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Perform needed repairs or treatment required on such sloping surfaces at once, followed by specified curing.

C. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete.

D. 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. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

E. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading. Reshoring accomplished in accordance with ACI 347 at no additional cost to the Government.

3.13 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.

3.14 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 will 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 Resident Engineer, 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 Resident Engineer 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 may be used to establish initial grade during strike-off, unless Resident Engineer 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 may 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 may 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 Resident Engineer from sample panel.

11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
    a. Areas covered with carpeting, or 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 17/F_L 15
            c) Level suspended slabs (shored until after testing) and topping slabs:
            d) Specified overall value FF 25/FL 20
            e) Minimum local value FF 17/FL 15
            f) Unshored suspended slabs:
            g) Specified overall value FF 25
            h) Minimum local value FF 17
            i) 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
            c) Level suspended slabs (shored until after testing) and topping slabs
            d) Specified overall value FF 30/FL 20
            e) Minimum local value FF 24/FL 15
            f) Unshored suspended slabs:
            g) Specified overall value FF 30
            h) Minimum local value FF 24
            i) 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 may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.
12. Measurements
    a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by Resident Engineer, to verify compliance with F_F, F_L, and other finish requirements. Measurements will 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 may 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 Department of Veterans Affairs retained testing laboratory.
    b. Contractor not experienced in using F_F and F_L 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 may 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 Resident Engineer, until a slab finish constructed within specified tolerances is accepted.

3.15 SURFACE TREATMENTS

A. Use on exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.

B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.

C. 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 m^2 (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.

3.16 APPLIED TOPPING

A. Separate concrete topping on floor base slab of thickness and strength shown. Topping mix shall have a maximum slump of 200 mm (8 inches) for concrete containing a high-range water-reducing admixture (superplasticizer) and 100 mm (4 inches) for conventional mix. Neatly bevel or slope at door openings and at slabs adjoining spaces not receiving an applied finish.

B. Placing: Place continuously until entire section is complete, struck off with straightedge, leveled with a highway straightedge or highway bull float, floated and troweled by machine to a hard dense finish. Slope to floor drains as required. Do not start floating until free water has disappeared and no water sheen is visible. Allow drying of surface moisture naturally. Do not hasten by "dusting" with cement or sand.

3.17 RESURFACING FLOORS:

A. Remove existing flooring areas to receive resurfacing to expose existing structural slab and extend not less than 25 mm (1 inch) below new finished floor level. Prepare exposed structural slab surface by roughening, broom cleaning, and dampening. Apply specified bonding grout. Place topping while the bonding grout is still tacky.

3.18 RETAINING WALLS:

A. Expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves installed and constructed as shown.

B. Exposed surfaces finished to match adjacent concrete surfaces, new or existing.

C. Place porous backfill, perforated PVC drain pipe and waterproofing as shown.

END OF SECTION

SECTION 03 30 53
MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION:

A. 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 03, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 AGENCY FOR CONCRETE MIX DESIGN:

A. Testing agency retained and reimbursed by the Contractor and approved by Resident Engineer.

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. AFormwork: 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. Lightweight aggregate for structural concrete.
   3. Air-entraining admixture.
   4. Chemical admixtures, including chloride ion content.
   5. Waterproof paper for curing concrete.
   6. Liquid membrane-forming compounds for curing concrete.
   7. Non-shrinking grout.
   8. Liquid hardener.
   9. Waterstops.
   10. Expansion joint filler.
   11. 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.

G. Shoring and Reshoring Sequence: Submit for approval a shoring and reshoring sequence for flat slab/flat plate portions, prepared by a registered Professional Engineer. As a minimum, include timing of form stripping, reshoring, number of floors to be re-shored and timing of re-shore removal to serve as an initial outline of procedures subject to modification as construction progresses. Submit revisions to sequence, whether initiated by Resident Engineer (see FORMWORK) or Contractor.

H. Certification that formwork has been designed by a professional Engineer licensed in the State of California. Stamped and sealed calculations shall be provided for shear wall formwork.

I. Test reports on splitting tensile strength (Fct) of lightweight concrete.

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 and fly ash 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; lightweight aggregate manufacturer; admixture manufacturers; Resident Engineer; Consulting Engineer; Department of Veterans Affairs 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 MOCK-UP

A. In addition to the other specified samples and tests, construct a mock-up using the materials, reinforcing, forming system and construction methods proposed for use in exposed architectural concrete.

B. Construct the mock-up with at least a 2.5 m by 2.5 m (8 feet by 8 feet) exposed surface and suitable foundations. Include the following where applicable: Control joints, reglets, recesses or other typical architectural details.

C. Before casting the mock-up, submit full detailed Shop Drawings of the mock-up formwork for review by the Architect. Perform all necessary preliminary tests to ensure that concrete used for the mock-up will exactly match the approved sample in color and texture.

D. Perform the surface treatment proposed for use on one or more areas not less than 300 mm by 300 mm (1 foot by 1 foot) on the back side of the mock-up to establish the texture of finish required by the Architect. Repeat as required until a sample satisfactory to the Architect has been obtained.

E. Treat the finished front surface of the mock-up to produce a uniform appearance similar in every respect to the approved sample area.

F. The completed mock-up shall be inspected by the Architect. Failure of the mock-up to match the approved sample will require the construction of further mock-ups until approval is obtained. Remove rejected mock-ups immediately.

G. Maintain the approved mock-ups in good condition at the job site until all architectural concrete surfaces have been completed and approved by the Architect. Remove the mock-up from the site after completion of the above.

1.10 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):

117-06	Tolerances for Concrete Construction and Materials
211.1-02	Selecting Proportions for Normal, Heavyweight, and Mass Concrete
211.2-04	Selecting Proportions for Structural Lightweight Concrete
214R-02	Evaluation of Strength Test Results of Concrete
301-05	Structural Concrete
304R-2000	Guide for Measuring, Mixing, Transporting, and Placing Concrete
305R-06	Hot Weather Concreting
306R-(2002)	Cold Weather Concreting
308R-(2001)	Standard Practice for Curing Concrete
309R-05	Guide for Consolidation of Concrete
31808	Building Code Requirements for Reinforced Concrete and Commentary
347R-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	Steel Wire, Plain, for Concrete Reinforcement
A185/185M-07	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
A615/A615M-08	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A653/A653M-07	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A706/A706M-06	Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A767/A767M-05	Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
A775/A775M-07	Epoxy-Coated Reinforcing Steel Bars
A820-06	Steel Fibers for Fiber-Reinforced Concrete
A996/A996M-06	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
C31/C31M-08	Making and Curing Concrete Test Specimens in the field
C33-07	Concrete Aggregates
C39/C39M-05	Compressive Strength of Cylindrical Concrete Specimens
C94/C94M-07	Ready-Mixed Concrete
C143/C143M-05	Slump of Hydraulic Cement Concrete
C150-07	Portland Cement
C171-07	Sheet Materials for Curing Concrete
C172-07	Sampling Freshly Mixed Concrete
C173-07	Air Content of Freshly Mixed Concrete by the Volumetric Method
C192/C192M-07	Making and Curing Concrete Test Specimens in the Laboratory
C231-08	Air Content of Freshly Mixed Concrete by the Pressure Method
C260-06	Air-Entraining Admixtures for Concrete
C309-07	Liquid Membrane-Forming Compounds for Curing Concrete
C330-05	Lightweight Aggregates for Structural Concrete
C494/C494M-08	Chemical Admixtures for Concrete
C496-06	Splitting Tensile Strength of Cylindrical Concrete Specimens
C567-05	Density of Structural Lightweight Concrete
C618-08	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C666/C666M-03	Resistance of Concrete to Rapid Freezing and Thawing

C881/C881M-02	Epoxy-Resin-Base Bonding Systems for Concrete
C1107/1107M-07	Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
C1315-08	Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
D6-95(R2006)	Loss on Heating of Oil and Asphaltic Compounds
D297-93(R2006)	Rubber Products-Chemical Analysis
D1751-04	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
D4397-02	Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
E1155-96(R2008)	Determining F_F Floor Flatness and F_L Floor Levelness Numbers

E. American Welding Society (AWS):

D1.4-05	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 may 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. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.

E. 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 µm (No. 100) sieve.

F. Mixing Water: Fresh, clean, and potable.

G. 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. 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 must 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. Microsilica: Use only with prior review and acceptance of the Resident Engineer. Use only in conjunction with high range water reducer.
   7. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.
   8. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
   9. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.

H. Vapor Barrier: ASTM D4397, 0.25 mm (10 mil).

I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.

J. Welded Wire Fabric: ASTM A185.

K. Reinforcing Bars to be Welded: ASTM A706.

L. Galvanized Reinforcing Bars: ASTM A767.

M. Epoxy Coated Reinforcing Bars: ASTM A775.

N. Cold Drawn Steel Wire: ASTM A82.

O. Reinforcement for Concrete Fireproofing: 100 mm x 100 mm x 3.4 mm diameter (4 x 4-W1.4 x W1.4) welded wire fabric, secured in place to hold mesh 20 mm (3/4 inch) away from steel. Mesh at steel columns shall be wired to No. 10 (No. 3) vertical corner steel bars. //

P. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m^2 (1.5 pounds per square yard), or square mesh at .6Kg/m^2 (1.17 pounds per square yard).

Q. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.

R. Expansion Joint Filler: ASTM D1751.

S. Sheet Materials for Curing Concrete: ASTM C171.

T. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.

U. Abrasive Aggregate: Aluminum oxide grains or emery grits.

V. Liquid Hardener and Dustproofer: Fluosilicate solution of magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer.

W. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous siliconate solution concrete surface treatment applied the day of the concrete pour in lieu of other curing methods for all concrete slabs receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays .

X. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34% solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.

Y. MVE 15-Year Warranty: When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer's instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a period of fifteen (15) years from the date of original installation. The warranty shall cover all labor and materials needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.

Z. 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.

AA. 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.

BB. Adhesive Binder: ASTM C881.
1. Polyvinyl Chloride Waterstop: CRD C572.
2. Rubber Waterstops: CRD C513.
3. Bentonite Water Stop: 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. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).
5. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m^3 (1.5 lb. per cubic yard). Product shall have a UL rating.
6. Steel Fibers: ASTM A820, Type I cold drawn, high tensile steel wire for use as primary reinforcing in slab-on-grade. Minimum dosage rate 18 kg/m^3 (30 lb. per cubic yard).
7. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
8. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.
9. 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 m^3 (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. include dry unit weight of lightweight structural concrete.
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. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Resident Engineer or as specified. Making and testing of preliminary test cylinders may 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. Resident Engineer may 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.

C. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Fly ash may be substituted for up to 20 percent of the minimum cement factor at option of Contractor, except fly ash may not be used in concrete designated as architectural concrete.

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. Lightweight Structural Concrete. Pump mixes may require higher cement values.
3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
   * Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

D. 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)

E. *Slump may 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 may 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 should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

F. 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

G. 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.

H. Lightweight structural concrete shall not weigh more than air-dry unit weight shown. Air-dry unit weight determined on 150 mm by 300 mm (6 inch by 12 inch) test cylinders after seven days standard moist curing followed by 21 days drying at 23 degrees C ± 1.7 degrees C (73.4 ± 3 degrees Fahrenheit), and 50 (plus or minus 7) percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.

I. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to 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. Air content as shown in 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 may 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, Resident Engineer may 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, Resident Engineer may 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, Resident Engineer may 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 Resident Engineer.

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 must be approved by Resident Engineer. 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 38^0C (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 Resident Engineer for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will 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 Resident Engineer.

PART 3 - PART 3 – EXECUTION

3.1 FORMWORK:

1. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a Professional Engineer registered in the State of California to design the formwork, shores, and reshores. Design, engineering, and construction of formwork for applicable gravity and lateral loads and pressures, as well as other design considerations or applicable requirements of Title 22, Division 7, Chapter 7, and Title 24, Part 6, Division T22 of California Administrative Code and legal local building code.

B.
1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Resident Engineer approves their reuse.
2. Provide forms for concrete footings unless Resident Engineer 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.

C. 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.

D. 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.

E. 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.

F. 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 may 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 to be 3d blued shingle or similar nails with thin flatheads.

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 shear walls or retaining wallsexcept where shown or permitted by Resident Engineer. Install sleeves in shear walls and retaining walls that are not shown, but are permitted by the Resident Engineer, 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 are to be 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 and ACI 315, 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. 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 will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 315. 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 will 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. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by Resident Engineer.
   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 Resident Engineer, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will 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. Department of Veterans Affairs retained testing laboratory will 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 Resident Engineer.

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 MOISTURE VAPOR EMISSIONS & ALKALINITY CONTROL SEALER:

A. 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, carpet, epoxy coatings and overlays.

B. Manufacturer's representative will 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:
   1. 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.
   2. Spray apply Sealer at the rate of 20 m^2 (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
   3. 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 Resident Engineer.

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.

E. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

3.6 EXPANSION JOINTS:

A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

B. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

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 Resident Engineer 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 will prevent segregation. Method of conveying concrete subject to approval of Resident Engineer.

D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD 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 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) 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.
   4. 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.
   5. 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 will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.

6. 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 may be a continuation of this concrete or concrete with a conventional slump.
7. 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:

A. 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 Resident Engineer.

3.9 COLD WEATHER:

A. Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyantes or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

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 may be used if approved by Resident Engineer.
   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 $10m^2/L$ (400 square feet per gallon) on steel troweled surfaces and $7.5m^2/L$ (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 may 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. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

C. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading. In addition, for flat slab/plate, reshoring is required immediately after stripping operations are complete and not later than the end of the same day. Reshoring accomplished in accordance with ACI 347 at no additional cost to the Government.

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 will 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 Resident Engineer, 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 Resident Engineer 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 may be used to establish initial grade during strike-off, unless Resident Engineer 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 may 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 may 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 Resident Engineer from sample panel.
11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
    a. Areas covered with carpeting, or not specified otherwise in b. below:

       Slab on Grade:

Specified overall value	F_F 25/F_L 20
Minimum local value	F_F 17/F_L 15

       Level suspended slabs (shored until after testing) and topping slabs:

Specified overall value	FF 25/FL 20
Minimum local value	FF 17/FL 15

       Unshored suspended slabs:

Specified overall value	FF 25
Minimum local value	FF 17

       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:

       Slab on grade:

Specified overall value	FF 36/FL 20
Minimum local value	FF 24/FL 15

       Level suspended slabs (shored until after testing) and topping slabs

Specified overall value	FF 30/FL 20
Minimum local value	FF 24/FL 15

       Unshored suspended slabs:

Specified overall value	FF 30
Minimum local value	FF 24

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 may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.

12. Measurements

a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by Resident Engineer, to verify compliance with F_F, F_L, and other finish requirements. Measurements will 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 may 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 Department of Veterans Affairs retained testing laboratory.

b. Contractor not experienced in using F_F and F_L 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 may 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 Resident Engineer, until a slab finish constructed within specified tolerances is accepted.

3.14 SURFACE TREATMENTS:

A. Use on exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish .

B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.

C. 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 m^2 (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.

3.15 APPLIED TOPPING:

A. Separate concrete topping on floor base slab of thickness and strength shown. Topping mix shall have a maximum slump of 200 mm (8 inches) for concrete containing a high-range water-reducing admixture (superplasticizer) and 100 mm (4 inches) for conventional mix. Neatly bevel or slope at door openings and at slabs adjoining spaces not receiving an applied finish.

B. Placing: Place continuously until entire section is complete, struck off with straightedge, leveled with a highway straightedge or highway bull float, floated and troweled by machine to a hard dense finish. Slope to floor drains as required. Do not start floating until free water has disappeared and no water sheen is visible. Allow drying of surface moisture naturally. Do not hasten by "dusting" with cement or sand.

3.16 RESURFACING FLOORS:

A. Remove existing flooring areas to receive resurfacing to expose existing structural slab and extend not less than 25 mm (1 inch) below new finished floor level. Prepare exposed structural slab surface by roughening, broom cleaning, and dampening. Apply specified bonding grout. Place topping while the bonding grout is still tacky.

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:

A. 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.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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.

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 the AISC certified Category of Conventional Steel Structures .

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 Resident Engineer.

1.4 TOLERANCES

A. Fabrication tolerances for structural steel shall be held within limits established by ASTM A6, by Section 7, Code of Standard Practice for Buildings and Bridges, and by Standard Mill Practice - General Information (AISC 13th edition , except as follows:
   1. Elevation tolerance for column splice points at time member is erected is 10 mm (3/8 inch).
   2. Elevation tolerance for top surface of steel beams and girders at connections to columns at time floor is erected is 13 mm (1/2 inch).
   3. 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 Resident Engineer 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 Resident Engineer. 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: Specification for Structural Steel Buildings LRFD Specification for Structural Steel Buildings.

B. AISC: 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, for:
   1. Interior Steel Stairs.

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. Load and Resistance Factor Design Specification for Structural Steel Buildings (13th Edition)
   2. Code of Standard Practice for Steel Buildings and Bridges (March 2000).

C. American National Standards Institute (ANSI):

B18.22.1-98	Plain Washers
B18.22M-00	Metric Plain Washers

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

A6/A6M-02	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
A36/A36M-01	Standard Specification for Carbon Structural Steel
A53/A53M-01	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A123/A123M-02	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A242/A242M-01	Standard Specification for High-Strength Low-Alloy Structural Steel
A283/A283M-00	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
A307-00	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
A325-02	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A490-02	Standard Specification for Heat-Treated Steel Structural Bolts 150 ksi Minimum Tensile Strength

A500-01	Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A501-01	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
A572/A572M-01	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
A992/A992M-02	Standard Specification for Structural Steel Shapes

E. American Welding Society (AWS):
D1.1-02 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 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..
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 proof load given in Specification for Structural Joints Using ASTM A325. 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 or the turn-of-the-nut method. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

3.2 FABRICATION

A. Fabrication in accordance with Chapter M, Specification for Steel Buildings Load and Resistance Factor Design.

3.3 SHOP PAINTING

A. General: Shop paint steel with primer in accordance with Section 6, Code of Standard Practice for Steel Buildings and Bridges.

B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.
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. Top flange of members which will have shear connector studs applied.

C. Structural steel in the interstitial space that does not receive sprayed on fireproofing shall be painted with primer in accordance with general requirement of shop painting.

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 Section 7, Code of Standard Practice for Steel Buildings and Bridges.

B. Temporary Supports: Temporary support of structural steel frames during erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.

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

A. Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that may be supported, attached, or applied to the structural steel work, submit a certified report of survey to Resident Engineer 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.

END OF SECTION

SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. 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.

B. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual Global and are listed in “Factory Mutual Research Approval Guide” for “Class 1” fire rated construction.

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
A611-97	Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
A653/A653M-08	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
C423-08	Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

C. American Institute of Steel Construction (AISC):
   1. Load and Resistance Factor Design Specification for Structural Steel Buildings (13th Edition)

D. American Iron and Steel Institute (AISI):
   1. Specification and Commentary for the Design of Cold-Formed Steel Structural Members

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, G60 .

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, but not limited to, 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 will 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.

C. Metal Form Deck – Type 2: Corrugated deck units used as a permanent form for reinforced concrete slabs. Comply with the depth and minimum gauge requirements as shown on the Contract Documents.
   1. Finish: Galvanized.

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: Galvanized G-60.

E. 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.

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 may 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 are to 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 Resident Engineer. 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:

A. 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:

A. Areas scarred during erection.

B. Welds to be thoroughly cleaned and touched-up. Touch-up paint for zinc-coated units shall be zinc rich galvanizing repair paint.

END OF SECTION

SECTION 05 36 00
COMPOSITE METAL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies material and services required for installation of composite steel decking including shear connector studs and miscellaneous closures required to prepare deck for concrete placement as shown and specified.

1.2 RELATED WORK

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

1.3 DESIGN REQUIREMENTS

A. Design steel decking in accordance with American Iron And Steel Institute publication "Specifications 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 information necessary to complete the installation as shown and specified, including supplementary framing, 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 as specified herein.

D. Manufacturer's written recommendations for:
   1. Shape of decking section to be used.
   2. Cleaning of steel decking prior to concrete placement.

E. Test Report - Establishing structural characteristics of composite concrete and steel decking system.

F. Test Report - Stud base qualification.

G. Welding power setting recommendation by shear stud manufacturer.

H. Shear Stud Layouts: Submit drawings showing the number, pattern, spacing and configuration of the shear studs for each beam and girder.

I. 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”.

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. Refer to the latest edition of all referenced Standards and codes.

B. American Iron and Steel Institute (AISI):
   1. Specification and Commentary for the Design of Cold-Formed Steel Structural Members (Latest Edition).

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

A36/A36M	Standard Specification for Carbon Structural Steel
A108	Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality
A653/A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process

D. American Institute of Steel Construction (AISC):
   1. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest 13th Edition)

E. American Welding Society (AWS):

D1.1	Structural Welding Code - Steel
D1.3	Structural Welding Code - Sheet Steel

F. Military Specifications (Mil. Spec.):

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Decking and all Flashings: ASTM A653, Structural Quality // suitable for shear stud weld-through techniques //.

B. Galvanizing: ASTM A653, G60 .

C. Shear connector studs: ASTM A108, Grades 1015-1020, yield 350 Mpa (50,000 psi) minimum, tensile strength - 400 Mpa (60,000 psi) minimum, reduction of area 50 percent minimum. Studs of uniform diameter; heads shall be concentric and normal to shaft; stud, after welding free from any substance or defect which would interfere with its function as a shear connector. Studs shall not be painted or galvanized. Size of studs shall be as shown on drawings. Studs manufactured by a company normally engaged in the manufacturer of shear studs and can furnish equipment suitable for weld-through installation of shear studs.

D. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.

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, but not limited to, 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 and concrete slab 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. Seat angles for deck: Where a beam does not frame into a column.

2.2 REQUIREMENTS

A. Steel decking depth, gage, and section properties to be as shown. Provide edges of deck with vertical interlocking male and female lip providing for a positive mechanical connection.

B. Fabricate deck units with integral embossments to provide mechanical bond with concrete slab. In combination with concrete slab, capable of supporting total design loads on spans shown.

C. Steel decking capable of safely supporting total, normal construction service loads without damage to decking unit.

D. Steel decking units shall include an integral system which provides a simple point of attachment for light duty hanger devices for flexibility for attaching hangers for support of acoustical, lathing, plumbing, heating, air conditioning and electrical items. System shall provide for minimum spacing pattern of 300 mm (12 inches) on centers longitudinally and 600 mm or 900 mm (24 or 36 inches) on centers transversely. Suspension system shall be capable of safely supporting a maximum allowable load of 45 kg (100 pounds) concentrated at any one hanger attachment point. System may consist of fold-down type hanger tabs or a lip hanger.

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. Erect steel deck in accordance with manufacturer's printed instructions.

E. Ship steel deck units to project in standard widths and cut to proper length.

F. Provide steel decking in sufficient lengths to extend over 3 or more spans, except where structural steel layout does not permit.

G. Place steel decking units on supporting steel framework and adjust to final position before being permanently fastening. Bring each unit to proper bearing on supporting beams. Place deck units in straight alignment for entire length of run of flutes and with close registration of flutes of one unit with those of abutting unit. Maximum space between ends of abutting units is 13 mm (1/2 inch). If space exceeds 13 mm (1/2 inch), install closure plates at no additional cost to Government.

H. Ceiling hanger loops, if used, must be flattened or removed to obtain bearing of units on structural steel.

I. 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.

J. Welding to conform to AWS D1.3 and done by competent experienced welding mechanics.

K. Areas scarred during erection and welds shall be thoroughly cleaned and touched-up with zinc rich galvanizing repair paint. Paint touch-up is not required for welds or scars that are to be in direct contact with concrete.

L. Provide metal concrete stops at edges of deck as required.

M. 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 are to 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 Resident Engineer. 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.

N. Installation of shear connector studs through previously installed metal deck to conform to AWS D1.1, Section 7, except all studs will be installed with automatically timed welding equipment and as specified below:
   1. Do not place reinforcing steel temperature mesh or other materials and equipment which will interfere with stud installation on steel deck until shear connector studs are installed.
   2. Steel deck sheets shall be free of oil, rust, dirt, and paint. Release water in deck's valley so that it does not become entrapped between deck and beam. Surface to which stud is to be welded shall be clean and dry.

3. Rest metal deck tightly upon top flange of structural member with bottom of deck rib in full contact with top of beam flange.
4. Weld studs only through a single thickness of deck. Place decking so that a butt joint is obtained. Place studs directly over beam web, where one row of studs are required.
5. Ferrules specially developed for the weld-through technique must be used. Ferrules shall be appropriate for size of studs used and be removed after welding.
6. Submit report of successful test program for stud base qualification as required by AWS D1.1, Appendix K.

3.2 CLEANING

A. Clean deck in accordance with manufacturer's recommendation before concrete placement.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies materials and services required for installation of cold-formed steel, including tracks and required accessories as shown and specified. This Section includes the following:
   1. Exterior load-bearing steel stud walls.
   2. Interior load-bearing steel stud walls.
   3. Exterior non-load-bearing steel stud curtain wall.
   4. Steel joists.

B. Completely coordinate with work of other trades.

1.2 RELATED WORK

A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.

B. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

C. Gypsum board assemblies: Section 09 29 00, GYPSUM BOARD.

1.3 DESIGN REQUIREMENTS

A. Design steel in accordance with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.

B. Structural Performance: Engineer, fabricate and erect cold-formed metal framing with the minimum physical and structural properties indicated.

C. Structural Performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.
   1. Design Loads: As indicated.
   2. Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-load-Bearing Curtain wall: Lateral deflection of 1/360 of the wall height.
   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 80 degrees F.
   4. Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
   5. Design exterior non-load-bearing curtain wall framing to accommodate lateral deflection without regard to contribution of sheathing materials.
   6. Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering cold-formed metal framing by employing a registered Structural Engineer (SE) licensed in the state of California to prepare design calculations, shop drawings, and other structural data.
   7. Framing System for Exterior Soffits – Additional Criteria
      a. In addition to gravity loads, design framing system to resist wind uplift.

8. Size and define headers reinforcing members around openings.
9. Develop details defining method of fastening throughout system.
10. Review and professionally seal submittals.

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 steel unit layout, connections to supporting members, and information necessary to complete installation as shown and specified.
   1. Complete Building Elevations defining framing member sizes, locations, and connection details.
      a. Show openings, edges and support conditions that have been field verified with respect to location.
      b. Show openings, edges and support conditions that have coordinated with respect to physical requirements of items to be installed in or on exterior wall system.
   2. Details and isometrics at windows showing layouts of Air Barrier Flashings and sequence of installation.

C. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.

D. For cold-formed metal framing indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer licensed in California who was responsible for its preparation.

1.5 APPLICABLE PUBLICATIONS

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

B. American Iron and Steel Institute (AISI):
   1. Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996)

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

A36/A36M(REV. A)-2003	Standard Specifications for Carbon Structural Steel
A123/A123M-2002	Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M-2003	Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A307-2002	Standard Specifications for Carbon Steel Bolts and Studs
A653/A653M-2003	Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
C955-2003	Standard Specifications for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
C1107-2002	Standard Specifications for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
E488-96(Reapproved 2003)	Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
E1190-95(Reapproved 2000)	Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members

D. American Welding Society (AWS):

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

E. Military Specifications (Mil. Spec.):
MIL-P-21035B(Reinst. Notice 2) Paint, High Zinc Dust Content, Galvanizing Repair

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Steel for joists, studs and accessories 16 gage and heavier: ASTM A653, structural steel, zinc coated G60 , with a yield of 340 MPa (50 ksi) minimum.

B. Sheet Steel for joists, studs and accessories 18 gage and lighter: ASTM A653, structural steel, zinc coated G60 , with a yield of 230 MPa (33 ksi) minimum.

C. Galvanizing Repair Paint: MIL-P-21035B.

D. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and a 30 minute working time.

2.2 WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:
   1. Design Uncoated-Steel Thickness; as required by metal stud engineer.
   2. Flange Width:
      a. (2 inches); as required
      b. (2-1/2 inches) ; as required
   3. Web: Punched or Unpunched ; as required.

B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:
   1. Design Uncoated-Steel Thickness: Matching steel studs.
   2. Flange Width: Manufacturer's standard deep flange where indicated, standard flange elsewhere.

C. Exterior Studs:
   1. Galvanized steel studs, runner channels and track, bracing and accessories, ASTM-A653/A653M minimum Z180 G60 galvanized.
   2. Member sizes and dimensions as indicated on drawings and as required by metal stud engineer.

2.3 EXTERIOR SHEATHING (GYPSUM)

A. Exterior Gypsum Sheathing:
   1. General Description: Water-resistant, mold-resistant suitable for long term weather exposure during construction.
   2. Comply with ASTM-C1177.
   3. Minimum Mold Resistance: 10 rating per ASTM-D3273.
   4. Minimum Thickness: 1/2 IN thick.
      a. Upgrade to 5/8 IN, thick Type X product version where fire rated Exterior walls are indicated.
      b. Soffit boards: Upgrade to appropriate non-sag product where sheathing is used horizontally as in soffits.
   5. Base Products:
      a. Description: Water-resistant treated gypsum core sheathing board with glass mat facers.

b. Approved products meeting this criteria:
   1) Dens-Glass Gold Exterior Sheathing by Georgia Pacific.
   2) e^2XP Extended Exposure Sheathing by National Gypsum.
   3) Securock Glass-Mat Sheathing by USG.
   4) Or approved equal.

6. Optional Products:
   a. Description: Facer-less, water-resistant treated gypsum core sheathing board with embossed drainage pattern on back.
   b. Approved products meeting this criteria:
      1) GlasRoc Sheathing by Certainteed.
      2) Or approved equal.

B. Seam Sealant and Fastener Head Sealant:
   1. Coordinate sealant for compatibility with selected air or vapor barrier systems and sheathing.

C. Finish System for Exterior Soffits and Ceiling Boards:
   1. General:
      a. System designed for compatibility with proposed brand of Exterior Ceiling/Soffit Board; The following is based on substrate using Dens-Glass Gold Exterior Sheathing by Georgia Pacific.
   2. Finish System:
      a. Reinforcing mesh and base coat.
      b. Base coat.
      c. Finish coat.
      d. Base Product: ToughRock setting compound, smooth finish.

D. Fasteners: Sized as required.
   1. Screws: Cadmium plated or stainless.
   2. Clips: Galvanized or zinc.
   3. Thread count as appropriate for stud materials specified.

E. Sheathing accessories: Galvanized, or zinc.

2.4 AIR AND VAPOR BARRIER, SELF-ADHERED TYPE

A. See Section 07 27 16.01

2.5 FRAMING ACCESSORIES

A. Fabricate steel framing accessories of the same material and finish used for framing members, with a minimum yield strength of 230 MPa (33 ksi).

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Gusset plates.
   5. Deflection track and vertical slide clips.
   6. Stud kickers and girts.
   7. Joist hangers and end closures.
   8. Reinforcement plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process according to ASTM A123.

B. Cast-in-Place Anchor Bolts and Studs: ASTM A307, Grade A, zinc coated by the hot-dip process according to ASTM A153.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.7 OTHER MATERIALS

A. Galvanizing repair coating: Tnemec 90-93 or ZRC Worldwide, Galvilite.

2.8 REQUIREMENTS

A. Welding in accordance with AWS D1.3

B. Furnish members and accessories by one manufacturer only.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrate for suitability to accept work.

B. Start of work constitutes acceptance of substrate and responsibility for performance.

3.2 FABRICATION

A. Framing components may be preassembled into panels. Panels shall be square with components attached.

B. Cut framing components squarely or as required for attachment. Cut framing members by sawing or shearing; do not torch cut.

C. Hold members in place until fastened.

D. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
   1. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   2. Locate mechanical fasteners and install according to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

E. Where required, provide specified insulation in double header members and double jamb studs which will not be accessible after erection.

3.3 ERECTION

A. Handle and lift prefabricated panels in a manner as to not distort any member.

B. Securely anchor tracks to supports as shown.

C. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.

D. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.

E. All axially loaded members shall be aligned vertically to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections.

F. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.

G. Install headers in all openings that are larger than the stud spacing in that wall.

H. Attach bridging for studs in a manner to prevent stud rotation. Space bridging rows as shown.

I. Studs in one piece for their entire length, splices will not be permitted.

J. Provide a load distribution member at top track where joist is not located directly over bearing stud.

K. Provide joist bridging and web stiffeners at reaction points where shown.

L. Provide end blocking where joist ends are not restrained from rotation.

M. Provide an additional joist under parallel partitions, unless otherwise shown, when partition length exceeds one-half joist span and when floor and roof openings interrupt one or more spanning members.

N. Provide temporary bracing and leave in place until framing is permanently stabilized.

O. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.

P. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

3.4 ERECTION – STUDS AND SHEATHING

A. Install cold-formed framing in accordance with requirements of ASTM-C1007 and with applicable sections of the AISI Standard for Cold-Formed Steel Framing General Provisions.

B. Comply with manufacturer's instructions.

C. Openings: Install header, jamb, and sill framing system per approved engineering documents

D. Expansion Joints at Portland Cement Plaster:
   1. Utilize double studs, spaced 3/8 IN apart, where expansion joints are indicated.
   2. Sheathing shall not be continuous across expansion joints.

E. Studs and runners:
   1. Align outside deep leg runner track accurately according to exterior wall layout.
   2. Fasten 12 IN OC, or as needed to satisfy design criteria.
   3. Position studs vertically in inside deep leg runners at required spacing.
   4. Install minimum of 2 studs each side of openings; use more if required to meet loadings.
   5. Anchorage:
      a. Top:

1) Allow 3/4 IN clearance between top of inside deep leg runner and outside deep leg runner.
2) Do not fasten inside deep leg runner to outside deep leg runner.
3) Fasten studs to inside deep leg runner.

b. Bottom:
1) Anchor each stud at bottom to runners with two, 3/8 IN minimum, type S-12 pan head screws.

6. Where stud design is outside edge of floor slab, provide galvanized connectors designed for loading requirements and allow individual floor movement without affecting integrity of stud system.
7. Shop weld assemblies as required to meet design requirements.
8. Touch-up burned off or abraded galvanizing with galvanizing repair coating.

F. Metal Wall Backing: Specified in Section 09 22 16.
1. Coordinate installation of metal wall backing used to support wall-supported items with installation of exterior stud wall system.
2. See Section 09 22 16 for items requiring metal wall backing.

G. Exterior Sheathing:
1. Edges of sheathing panels to land at stud centers.
2. Screw to exterior of each stud as recommended by manufacturer.
3. Butt sheathing boards together tightly:
a. Maximum gap between boards: 1/8 IN.
b. Seal seams and fastener heads with sealant per Method 1 as described by Georgia Pacific.
4. Sheathing at roof-side of parapet walls:
a. Apply sheathing on roof side of stud framed parapet walls.
b. Sheathing not required where parapet back-up walls are CMU.

H. Exterior Ceilings and Soffits:
1. Control Joints;
a. Locate control joints in a manner that subdivides ceilings/soffits as indicated, and within the following limits: Subdivide so that no area exceeds 900 FT^2, and no area has a length which exceeds 30 FT.
b. Locate control joints at transitions between areas of different shapes.
2. Finish System:
a. Tape joints with glass mesh tape.
b. Fill screw heads.
c. Apply skim coat over entire surface.
3. Paint: Specified in Section 09 91 13.01 Exterior Painting.

3.5 TOLERANCES

A. Vertical alignment (plumbness) of studs shall be within 1/960th of the span.

B. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths.

C. Spacing of studs shall not be more than 3 mm (1/8 inch) +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.

D. Prefabricated panels shall be not more than 3 mm (1/8 inch) +/- out of square within the length of that panel.

3.6 INSTALLATION OF AIR BARRIER

A. See Division 7

3.7 PROTECTION

A. Protect erected wall and openings with temporary covers until finish, roofing, flashing and windows are installed.

3.8 FIELD REPAIR

A. Touch-up damaged galvanizing with galvanizing repair paint.

B. Repair portions of sheathing which is damaged by rain, wind, or prolonged exposure.

C. Repair portions of Air Retarder which are damaged by wind or due to prolonged exposure.
   1. Damage shall include rips, tears, loss of adhesion of seam tape, and elongation of membrane at fastener penetrations.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.

B. Items specified.
1. Support for Wall and Ceiling Mounted Items: (12, 14A, 14C)
2. Frames: (24E)
3. Guards
4. Covers and Frames for Pits and Trenches.
5. Gratings
6. Loose Lintels
7. Gas Racks
8. Plate Door Sill
9. Safety Nosings
10. Ladders
11. Railings: (10)
12. Sidewalk Access Doors
13. Screened Access Doors

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:

C.

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

D. 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.

E. Manufacturer's Certificates:
1. Anodized finish as specified.
2. Live load designs as specified.

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.

1.5 APPLICABLE PUBLICATIONS

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

B. American Society of Mechanical Engineers (ASME):

B18.6.1-81(R1997)	Wood Screws
B18.2.2-87(R2005)	Square and Hex Nuts

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

A36/A36M-05	Structural Steel
A47-99(R2004)	Malleable Iron Castings
A48-03	Gray Iron Castings
A53-06	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A123-02	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A167-99(R2004)	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
A269-07	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A307-07	Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
A312/A312M-06	Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
A391/A391M-01	Grade 80 Alloy Steel Chain
A653/A653M-07	Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
A786/A786M-05	Rolled Steel Floor Plate

B221-06	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
B456-03	Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
B632-02	Aluminum-Alloy Rolled Tread Plate
C1107-07	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
D3656-04	Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
F436-07	Hardened Steel Washers
F468-06	Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
F593-02	Stainless Steel Bolts, Hex Cap Screws, and Studs
F1667-05	Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):

D1.1-04	Structural Welding Code Steel
D1.2-03	Structural Welding Code Aluminum
D1.3-98	Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)

AMP521-01	Pipe Railing Manual
AMP 500-505-1988	Metal Finishes Manual
MBG 531-00	Metal Bar Grating Manual
MBG 532-00	Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC):

SP 1-05	No. 1, Solvent Cleaning
SP 2-05	No. 2, Hand Tool Cleaning
SP 3-05	No. 3, Power Tool Cleaning

G. Federal Specifications (Fed. Spec):

RR-T-650E	Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.

B. Ladders and Rungs: 120 kg (250 pounds) at any point.

C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

D. Floor Plates, Gratings, Covers : 500 kg/m^2 (100 pounds per square foot). Use 300 (pounds) for concentrated loads.

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

2.2 MATERIALS

A. Structural Steel: ASTM A36.

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

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

D. Floor Plate:

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

E. Steel Pipe: ASTM A53.
1. Galvanized for exterior locations.
2. Type S, Grade A unless specified otherwise.
3. NPS (inside diameter) as shown.

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

G. Malleable Iron Castings: A47.

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

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

J. Modular Channel Units:
1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
2. Form channel with in turned pyramid shaped clamping ridges on each side.
3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

2.3 HARDWARE

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

B. Fasteners:
1. Bolts with Nuts:
a. ASME B18.2.2.
b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
c. ASTM F468 for nonferrous bolts.
d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION GENERAL

A. Material
1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.

2. Use material free of defects which could affect the appearance or service ability of the finished product.

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

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

D. Fasteners and Anchors
1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship
1. General:
   a. Fabricate items to design shown.
   b. Furnish members in longest lengths commercially available within the limits shown and specified.
   c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
   d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
   e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
   f. Prepare members for the installation and fitting of hardware.
   g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
   h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
   a. Weld in accordance with AWS.

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

3. Joining:
   a. Miter or butt members at corners.
   b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
   a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
   b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
   a. Accurately cut, machine and fit joints, corners, copes, and miters.
   b. Fit removable members to be easily removed.
   c. Design and construct field connections in the most practical place for appearance and ease of installation.
   d. Fit pieces together as required.
   e. Fabricate connections for ease of assembly and disassembly without use of special tools.
   f. Joints firm when assembled.
   g. Conceal joining, fitting and welding on exposed work as far as practical.
   h. Do not show rivets and screws prominently on the exposed face.
   i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:
1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
2. Aluminum: NAAMM AMP 501.
   a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
   b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
   c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
   d. Painted: AA-C22R10.
3. Steel and Iron: NAAMM AMP 504.
   a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
   b. Surfaces exposed in the finished work:
      1) Finish smooth rough surfaces and remove projections.
      2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
   c. Shop Prime Painting:
      1) Surfaces of Ferrous metal:
         a) Items not specified to have other coatings.
         b) Galvanized surfaces specified to have prime paint.
         c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.

d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

2) Non ferrous metals: Comply with MAAMM-500 series.

4. Stainless Steel: NAAMM AMP-504 Finish No. 4.
5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

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

2.5 SUPPORTS

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

B. For Ceiling Hung Toilet Stall:
1. Use a continuous steel channel above pilasters with hangers centered over pilasters.
2. Make provision for installation of stud bolts in lower flange of channel.
3. Provide a continuous steel angle at wall and channel braces spaced as shown.
4. Use threaded rod hangers.
5. Provide diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.

C. For Wall Mounted Items:
1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
4. Steel hat channels where shown. Flange cut and flatted for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

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

b. Fabricate eye bolt, special clamp bolt, and plate closure full length of modular channel at ceiling line and secure to modular channel unit with manufacturers standard fittings.

E. 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.

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 COVERS AND FRAMES FOR PITS AND TRENCHES

A. Fabricate covers to support live loads specified.

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

C. Steel Frames:
   1. Form frame from structural steel angles as shown. Where not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles for frame openings over 1200 mm (4 feet) long and 50 x 50 x 6 mm (2 ix 2 x 1/4 inch) for frame openings less than 1200 mm (4 feet).
   2. Fabricate intermediate supporting members from steel "T's" or angles; located to support cover section edges.
   3. Where covers are required use steel border bars at frames so that top of cover will be flush with frame and finish floor.
   4. Weld steel strap anchors to frame. Space straps not over 600 mm (24 inches) o.c., not shown otherwise between end anchors. Use 6 x 25 x 200 mm (1/4 x 1 x 8 inches) with 50 mm (2 inch) bent ends strap anchors unless shown otherwise.
   5. Drill and tap frames for screw anchors where plate covers occur.

2.9 GRATINGS

A. Fabricate gratings to support live loads specified and a concentrated load as specified.

B. Provide clearance at all sides to permit easy removal of grating.

C. Make cutouts in gratings with 6 mm (1/4 inch) minimum to 25 mm (one inch) maximum clearance for penetrations or passage of pipes and ducts. Edge band cutouts.

D. Fabricate in sections not to exceed 2.3 m^2 (25 square feet) in area and 90 kg (200 pounds) in weight.

E. Fabricate sections of grating with end-banding bars.

F. Fabricate angle frames and supports, including anchorage as shown.
   1. Fabricate intermediate supporting members from "T's" or angles.
   2. Locate intermediate supports to support grating section edges.
   3. Fabricate frame to finish flush with top of grating.
   4. Locate anchors at ends and not over 600 mm (24 inches) o.c.
   5. Butt or miter, and weld angle frame at corners.

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

2.10 LOOSE LINTELS

A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.

B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.

C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.
   1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
   2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

E. Provide bearing plates for lintels where shown.

F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.

G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.

H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.

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

2.11 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 LADDERS

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

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

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

2.14 RAILINGS

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

B. Fabrication General:
   1. Provide continuous welded joints, dressed smooth and flush.
   2. Standard flush fittings, designed to be welded, may be used.
   3. Exposed threads will not be approved.
   4. Form handrail brackets to size and design shown.
   5. Exterior Post Anchors.
      a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
      b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
      c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts.
   6. Interior Post Anchors:
      a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
      b. Weld or thread flanged fitting to posts at base.
      c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
      d. Provide sliding flange base plate on posts secured with set screws.
      e. Weld flange base plate to removable posts set in sleeves.

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

D. Steel Pipe Railings:
   1. Fabricate of steel pipe with welded joints.
   2. Number and space of rails as shown.
   3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
   4. Form handrail brackets from malleable iron.
   5. Fabricate removable sections with posts at end of section.
   6. Removable Rails:
      a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
      b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
      c. Continuously weld brackets to post.
      d. Provide slotted bolt holes in rail bracket.
      e. Weld bolt heads flush with top of rail.
      f. Weld flanged fitting to post where posts are installed in sleeves.
   7. Chains:
      a. Chains: ASTM A391, Grade 63, straight link style, normal size chain bar 8 mm (5/16 inch) diameter, eight links per 25 mm (foot) and with boat type snap hook on one end, and through type eye bolt on other end.
      b. Fabricate eye bolt for attaching chain to pipe posts, size not less than 9 mm (3/8 inch) diameter.
      c. Fabricate anchor at walls, for engagement of snap hook of either a 9 mm (3/8 inch) diameter eye bolt or punched angle.
      d. Galvanize chain and bolts after fabrication.

E. Aluminum Railings:
   1. Fabricate from extruded aluminum.
   2. Use tubular posts not less than 3 mm (0.125 inch) wall thickness for exterior railings.
   3. Punch intermediate rails and bottom of top rails for passage of posts and machine to a close fit.
   4. Where shown use extruded channel sections for top rail with 13 mm (1/2 inch) thick top cover plates and closed ends.
   5. Fabricate brackets of extruded or wrought aluminum as shown.
   6. Fabricate stainless pipe sleeves with closed bottom at least six inches deep having internal dimensions at least 13 mm (1/2 inch) greater than external dimensions of posts where set in concrete.

2.15 SIDEWALK DOOR

A. Use flush, watertight, gutter type design.

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

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

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

E. Doors removable without disturbing frame.

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

2.16 SCREENED ACCESS DOORS AND FRAMES

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

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

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

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

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Items set into concrete or masonry.
   1. Provide temporary bracing for such items until concrete or masonry is set.
   2. Place in accordance with setting drawings and instructions.
   3. Build strap anchors, into masonry as work progresses.

C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.

D. Field weld in accordance with AWS.
   1. Design and finish as specified for shop welding.
   2. Use continuous weld unless specified otherwise.

E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

A. Anchorage to structure.
   1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
   2. Secure supports to concrete inserts by bolting or continuous welding as shown.
   3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
   4. Secure steel plate or hat channels to studs as detailed.

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

C. Supports for Wall Mounted items:
   1. Locate center of support at anchorage point of supported item.
   2. Locate support at top and bottom of wall hung cabinets.
   3. Locate support at top of floor cabinets and shelving installed against walls.
   4. Locate supports where required for items shown.

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

3.3 COVERS AND FRAMES FOR PITS AND TRENCHES

A. Set frame and cover flush with finish floor.

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

3.4 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.

3.5 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.

3.6 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. Install Guard Angles at Edges of Stairwell, Openings in Slab 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.

3.7 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.

3.8 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.

3.9 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 LADDERS

A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.

B. In elevator pits, set ladders to clear all elevator equipment where shown on the drawings.
   1. Where ladders are interrupted by division beams, anchor ladders to beams by welding, and to floors with expansion bolts.
   2. Where ladders are adjacent to division beams, anchor ladders to beams with bent steel plates, and to floor with expansion bolts.

C. Ladder Rungs:
   1. Set step portion of rung 150 mm (6 inches) from wall.
   2. Space rungs approximately 300 mm (12 inches) on centers.
   3. Where only one rung is required, locate it 400 mm (16 inches) above the floor.

3.12 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. Chains:
   1. Eye bolt chains to pipe posts.
   2. Eye bolt anchoring at walls.
      a. Expansion bolt to concrete or solid masonry.

F. 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.

3.13 SIDEWALK DOOR, TRAP DOORS, AND FRAMES

A. Set frame flush with finished concrete slab or curb.

B. Secure well linings to structure with expansion bolts unless shown otherwise.

C. Bolt ceiling hatch to well lining angle brace and to angle iron frames near corners and 300 mm (12 inches) on centers with not less than 9 mm (3/8 inch) roundhead machine screws.

D. Coordinate sidewalk door drain connections with plumbing work.

3.14 SCREENED ACCESS DOOR

A. Set frame in opening so that clearance at jambs is equal and secure with expansion bolts.

B. Use shims at bolts to prevent deformation of frame members in prepared openings.

C. Set frame in mortar bed and build in anchors as the masonry work progresses.

D. Grout jambs solid with mortar.

E. Secure insect screen to inside of door with stainless steel fasteners on doors in exterior walls.

3.15 CLEAN AND ADJUSTING

A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.

B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

END OF SECTION

SECTION 05 51 00
METAL STAIRS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section specifies steel stairs with railings.

B. Types:
   1. Closed riser stairs with concrete filled treads and platforms.

1.2 RELATED WORK

A. Concrete fill for treads and platforms: Section 03 30 00, CAST-IN-PLACE CONCRETE.

B. Wall handrails and railings for other than steel stairs: Section 05 50 00, METAL FABRICATIONS.

C. Requirements for shop 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. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.

C. Design calculations stamped by required professional engineer in State of California.

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 basic designation.

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

A36/A36M-05	Structural Steel
A47-99 (R2004)	Ferritic Malleable Iron Castings
A48-03	Gray Iron Castings
A53-06	Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
A307-07	Carbon Steel Bolts and Studs, 60000 psi Tensile Strength
A653/653M-07	Steel Sheet, Zinc Coated (Galvanized) or Zinc Alloy Coated (Galvannealed) by the Hot-Dip Process
A563-07	Carbon and Alloy Steel Nuts
A1008-07	Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy
A786/A786M-00	Rolled Steel Floor Plates
A1011-04	Steel, Sheet and Strip, Strip, Hot-Rolled Carbon, Structural, High-Strength, Low-Alloy

C. American Welding Society (AWS):

D1.1-04	Structural Welding Code-Steel
D1.3-98	Structural Welding Code-Sheet Steel

D. The National Association of Architectural Metal Manufactures (NAAMM) Manuals:

Metal Bar Gratings (ANSI/NAAMM MBG 531-00)
AMP521-01 Pipe Railing Manual, Including Round Tube

E. American Iron and Steel Institute (AISI):
2001 Design of Cold-Formed Steel Structural Members

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. Design stairs to support a live load of 500 kg/m^2 (100 pounds per square foot), and a point load of 300 lbs over 4 sq. in.

B. Structural design, fabrication and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.

C. Design Grating treads in accordance with NAAMM Metal Bar Grating Manual.

D. Design pipe railings in accordance with NAAMM Pipe Railing Manual for 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

A. Steel Pipe: ASTM A53, Standard Weight, zinc coated.

B. Steel Grating: Metal bar type grating NAAMM BG.

C. Sheet Steel: ASTM A1008.

D. Structural Steel: ASTM A36.

E. Steel Floor Plate: ASTM 786.

F. Steel Decking: Form from zinc coated steel conforming to ASTM A446, with properties conforming to AISI Specification for the Design of Cold-Formed Steel Structural Members.

G. Steel Plate: ASTM A1011.

H. Iron Castings: ASTM A48, Class 30.

I. Malleable Iron Castings: ASTM A47.

2.3 FABRICATION GENERAL

A. Fasteners:
1. Conceal bolts and screws wherever possible.
2. Use countersunk heads on exposed bolts and screws with ends of bolts and screws dressed flush after nuts are set.

B. Welding:
1. Structural steel, AWS D1.1 and sheet steel, AWS D1.3.
2. Where possible, locate welds on unexposed side.
3. Grind exposed welds smooth and true to contour of welded member.
4. Remove welding splatter.

C. Remove sharp edges and burrs.

D. Fit stringers to head channel and close ends with steel plates welded in place where shown.

E. Fit face stringer to newel post by tenoning into newel post, or by notching and fitting face stringer to side of newel where shown.

F. Shop Prime Painting: Prepare surface and apply primer as specified for ferrous metals in Section 09 91 00, PAINTING.

2.4 RAILINGS

A. Fabricate railings, including handrails, from steel pipe with flush.
   1. Connections may be standard fittings designed for welding, or coped or mitered pipe with full welds.
   2. Wall handrails are provided under Section 05 50 00, METAL FABRICATIONS.

B. Return ends of handrail to wall and close free end.

C. Provide standard terminal castings where fastened to newel.

D. Space intermediate posts not over six feet on center between end post or newel post .

E. Fabricate handrail brackets from cast malleable iron.

F. Provide standard terminal fittings at ends of post and rails.

2.5 CLOSED RISER STAIRS

A. Provide treads, risers, platforms, railings, stringers, headers and other supporting members.

B. Fabricate pans for treads and platforms, and risers from sheet steel.

C. Form risers with sanitary cove.

D. Fabricate stringers, headers, and other supporting members from structural steel.

E. Construct newel posts of steel tubing having wall thickness not less than 5 mm (3/16-inch), with forged steel caps and drops.

PART 3 - EXECUTION

3.1 STAIR INSTALLATION

A. Provide hangers and struts required to support the loads imposed.

B. Perform job site welding and bolting as specified for shop fabrication.

C. Set stairs and other members in position and secure to structure as shown.

D. Install stairs plumb, level and true to line.

E. Provide steel closure plate to fill any gap between the stringer and surrounding shaft wall. Weld and finish with prime and paint finish of adjoining steel.

3.2 RAILING INSTALLATION

A. Install standard terminal fittings at ends of posts and rails.

B. Secure brackets, posts and rails to steel by welds, and to masonry or concrete with expansion sleeves and bolts, except secure posts at concrete by setting in sleeves filled with commercial non-shrink grout.

C. Set rails horizontal or parallel to rake of stairs to within 3 mm in 3650 mm (1/8-inch in 12 feet).

D. Set posts plumb and aligned to within 3 mm in 3650 mm (1/8-inch in 12 feet).

3.3 FIELD PRIME PAINTING

A. When installation is complete, clean field welds and surrounding areas to bright metal, and coat with same primer paint used for shop priming.

B. Touch-up abraded areas with same primer paint used for shop priming.

C. Touch up abraded galvanized areas with zinc rich paint as specified in section 09 91 00, PAINTING.

END OF SECTION

SECTION 06 16 63
CEMENTITIOUS SHEATHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies cement board sheathing applied to frame wall construction, ready to receive subsequent finishes.

1.2 SUBMITTALS

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

B. Samples:
1. Cement board panels, 200 mm by 200 mm (8 inches by 8 inches), minimum size.
2. Fasteners, each type used.
3. Reinforcing tape for joints 300 mm (12 inches) long.
4. Water barrier backing, 300 mm (12 inches) square.

C. Product Data:
1. Cement board sheathing.
2. Reinforcing tape.
3. Fasteners.

1.3 DELIVERY AND STORAGE

A. Deliver materials in containers with labels legible and intact.

B. Store materials so as to prevent damage or contamination.

1.4 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute (ANSI):

A108.11-1999	Interior Installation of Cementitious Backer Units
A118.9-1999	Cementitious Backer Units

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

C954-04	Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
D226-06	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
D4586-07	Asphalt Roof Cement, Asbestos-Free

D. Federal Specifications (FS):

UU-B-790	Building Paper, Vegetable Fiber INT AMD 1 (Kraft, Waterproofed, Water Repellant and Fire Resistant)

PART 2 - PRODUCTS

2.1 CEMENT BOARD SHEATHING

A. Conform to ANSI A118.9, except physical property requirements defined in Table 1 changed to not less than the minimum values stated below.

B. Property Minimum Average Value
   1. Water Absorption by Weight, ASTM D1037 20 percent maximum
   2. Flame Spread 5
   3. Smoke Density 0
   4. Thickness 13 mm (1/2 inch)
   5. Minimum Width 800 mm (32 inches)

2.2 ACCESSORY MATERIALS

A. Steel Drill Screws: ASTM C954. Modified for flat head. Bugle head not acceptable.

B. Organic Felt: ASTM D226, Type II, 13.6 kg (30 lb).

C. Roof Cement: ASTM D4586

D. Joint Reinforcing Tape:
   1. Minimum 100 mm (4-inches) wide open mesh alkali resistant.
   2. Glass fiber mesh polymer coated as recommended by Cement Board manufacturer.

E. Water Barrier: FS UU-B-790. Type I (Barrier paper), Grade D (Water-vapor permeable). Other products meeting or exceeding the Federal specification for a water barrier with water vapor permeability are acceptable.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Do not install units when temperature is below 4.5 degrees Celsius (40 degrees F).

B. Do not install joint reinforcing tape when temperature is below 10 degrees Celsius (50 degrees F).

3.2 INSTALLATION

A. Remove wrapping and separate to allow air circulation for not less than seven days before installation.

B. Installing Water Barrier over Framing Members:
   1. Apply roof cement or tape to framing members sufficient to adhere and support water barrier.
   2. Use either organic felt or water barrier.
   3. Apply barrier shingle fashion with horizontal joints lapped not less than 50 mm (2 inches). Lap end joints over framing, not less than 100 mm (4 inches) cemented together with roof cement, stagger end joints.
   4. Do not leave over 300 mm (12-inch) wide strip exposed when work is stopped.
   5. Coordinate with installation of flashing to lap water barrier over flashing. Install weeps every 600 mm (24 inches) or as detailed, directly above flashing. Provide for clear exit of water to exterior.
   6. Repair torn or cut barrier with barrier patch spanning framing space cemented to surface along top and side edges.

C. Installing Cement Board Units:
   1. Apply cement board sheathing immediately over water barrier in accordance with ANSI A108.11, with rounded edges and rough side to exterior, except as specified otherwise.
   2. Secure units to framing members with screws spaced not more than 200 mm (8 inches) on center and not closer than 13 mm (1/2-inch) from the edge of the unit.
   3. Install screws so that the screw heads do not penetrate the surface of unit.
   4. Install 13 mm (1/2-inch) wide horizontal control joints at floors and vertical control joints not over 4.87 m (16 feet) on center unless shown otherwise, maintain alignment.
   5. Stop units at edges of building expansion joints.
   6. Minimum bearing over framing members: 19 mm (3/4-inch.)

D. Joint and Surface Treatment: Apply joint reinforcing tape over joints, exposed edges, and corners using adhesive recommended by manufacturer.

E. Leave surface flush and ready to receive subsequent finishes.

3.3 PROTECTION AND REPAIR

A. Protect board with temporary coverings against moisture until subsequent finish is applied.

B. Patch and repair damaged surface prior to application of subsequent finish.
   1. Fill cracks.
   2. Replace loose, spalling or missing joint finish.
   3. Replace broken or damaged boards.

END OF SECTION

SECTION 07 08 00
FACILITY EXTERIOR CLOSURE COMMISSIONING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 07 and Division 08.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. This Section includes requirements for commissioning the Facility exterior closure, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

C. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 07 and Division 08 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.

B. The following Facility exterior closure systems will be commissioned:
   1. Roofs (built-up bituminous, modified bituminous, , flashing & sheet metal, roof specialties, and roof accessories)
   2. Curtain Wall Systems (Mullions, glazing, and sealing)
   3. Exterior Doors (glass leaf, emergency exit, and service)
   4. Exterior Windows (Aluminum, steel, glazing,)
   5. Louvers and Vents
   6. Sealants (Caulking, mechanical seals, and wind and vapor barriers)

1.6 SUBMITTALS

A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.2 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 07 or Division 08 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.3 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.4 TRAINING OF VA PERSONNEL

A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 21 Sections for additional Contractor training requirements.

END OF SECTION

SECTION 07 12 00
BUILT-UP BITUMINOUS WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies impervious built-up membranes of bituminous materials used for waterproofing.

1.2 RELATED WORK

A. Reglets: Section 07 60 00, FLASHING AND SHEET METAL.

B. Cement Topping: Section 03 30 00, CAST-IN-PLACE CONCRETE.

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data: Fiberboard, asphalt primer, felts and fabrics (each type to be used)

C. Certificates: Indicating materials conform to contract specifications.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to job in manufacturer's original unopened containers with brand name marked thereon.

B. Before proceeding with work, protect surfaces from excessive changes in temperature and protect piping, conduits and installed equipment and materials.

1.5 APPLICABLE PUBLICATIONS:

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

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

C208-95 (R2001)	Cellulosic Fiber Insulating Board
D41-94 (2000)	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D43-00	Coal Tar Primer used in Roofing, Dampproofing, and Waterproofing
D173-03	Bitumen-Saturated Cotton Fabrics used in Roofing and Waterproofing
D226-97	Asphalt-Saturated Organic Roofing Felt Used in Roofing and Waterproofing
D227-03	Coal-Tar-Saturated Organic Roofing Felt Used in Roofing and Waterproofing
D449-03	Asphalt Used in Dampproofing and Waterproofing
D450-96(R2006)	Coal Tar Pitch Used in Roofing, Dampproofing, and Waterproofing
D1327-04	Bitumen-Saturated Woven Burlap Fabrics Used in Roofing and Waterproofing
D1668-97(R2006)	Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
D2178-04	Asphalt Glass Felt Used in Roofing and Waterproofing
D4022-07	Coal Tar Roof Cement
D4586-07	Asphalt Roof Cement, Asbestos-Free

PART 2 - PRODUCTS

2.1 BITUMEN:

A. Asphalt: ASTM D449, Type I, for exterior work below grade, Type III for work above grade, where asphalt will be exposed to sunlight.

B. Coal-Tar: ASTM D450, Type II.

2.2 FELTS AND FABRICS (FOR USE WITH ASPHALT):

A. Cotton Fabric Asphalt-Saturated: ASTM D173.

B. Organic Felt Asphalt-Saturated: ASTM D226, Type I.

C. Glass Mat (Fabric) Asphalt-impregnated: ASTM D2178, Type IV.

2.3 FELTS AND FABRICS (FOR USE WITH COAL-TAR):

A. Cotton Fabric Coal-Tar Saturated: ASTM D173.

B. Organic Felt Coal-Tar Saturated: ASTM D227.

C. Burlap (Fabric) Coal-Tar Saturated: ASTM D1327.

D. Glass Fabric, Coal-Tar Treated: ASTM D1668.

2.4 PRIMER:

A. Use ASTM D41 for asphalt products.

B. Use ASTM D43 for coal-tar products.

2.5 FIBERBOARD:

A. ASTM C208, Type V, Class C, 13 mm (1/2-inch) thick.

2.6 CEMENT:

A. ASTM D4022 with coal tar products.

B. ASTM D4586 with asphalt products.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Do not apply waterproofing when ambient temperature is 4.4^{o}C (40°F) or lower.

B. Cleaning and Filling:
   1. Before applying waterproofing materials, clean surfaces smooth, firm and dry.
   2. Remove high spots, depressions, loose and foreign particles; and fill all voids, joints and cracks with Portland cement mortar.
   3. Surface shall be approved by Resident Engineer before waterproofing is started.

3.2 GENERAL:

A. Ventilation: Provide adequate ventilation for waterproofing installed in enclosed spaces.

B. Compatibility of Materials: Use coal-tar pitch with coal-tar-saturated felts and fabric. Use asphalt with asphalt-saturated felts and fabrics.

C. Temperature of Bitumen: Heat bitumen to flow freely when applied, but not above 190°C (375°F) for coal-tar, and not above 230°C (450°F) for asphalt.

D. Rate of Application: Apply primers at the rate of 0.4 L/m^2 (one gallon per 100 square feet) over concrete and parging. Apply coal-tar at the rate of 1.9 kg/m^2 (40 pounds per 100 square feet) and asphalt at the rate of 1.5 kg/m^2 (30 pounds per 100 square feet), for each mopping.

E. Number of Plies:
   1. Membrane waterproofing shall consist of four plies of felt or fabric.
   2. Install membrane by lapping each ply approximately three-quarters over the preceding ply.
   3. Use appropriate width starting strips of felt or fabric at the starting line to provide four plies at the edge.

3.3 APPLICATION

A. Exterior Vertical Surfaces:
   1. Start each ply at the bottom, placed vertically, in hot bitumen and complete prior to applying the next ply.
   2. Overlap plies downward.
   3. Lap each ply 100 mm (4 inches) at the end. Stagger end laps not less than 450 mm (18 inches) in relation to preceding layer.
   4. Bitumen shall be applied to exterior vertical surfaces with cotton roller mops or other approved application devices.
   5. Waterproofing membranes shall be installed vertically, shingle fashion, in the manner specified herein.
   6. The membrane shall extend 50 mm (2 inches) from the outer edge of footing, across the top of the footing, and up foundation wall to approximately 100 mm (4 inches) below the finished grade.
   7. Tops of the membranes shall be secured and protected as required by manufacturer .

B. Horizontal Surfaces:
   1. Apply waterproofing membranes for floor slabs to a primed, smooth surface base slab.
   2. Apply felts shingle fashion in moppings of hot bitumen.
   3. Carry membranes up abutting vertical surfaces to the level approximately 150 mm (six inches) above the finish floor unless otherwise shown.
   4. Extend felts to intersections with interior surfaces of foundation walls.
   5. Where membranes pass over interior footings for load-bearing partitions, they shall be reinforced with two plies of fabric membrane in moppings of hot bitumen applied at the rate specified.
   6. The fabric plies shall extend a minimum of 150 mm and 200 mm (6 and 8 inches), respectively, beyond the edges of the footing.
   7. After all reinforcing membranes have been installed, the entire surface shall be covered uniformly with hot bitumen applied at the rate specified.

C. Fabric Membrane Reinforcement:
   1. Provide fabric membranes to reinforce felts at intersections.
   2. Reinforcement shall consist of two plies of fabric membrane cemented in place and to each other with roofing cement not less than 2 mm (1/16 inch) thick for each coating.
   3. At the intersection of slabs and vertical surfaces, extend the first ply at least 150 mm (6 inches) on the slab and 100 mm (4 inches) up the vertical surface.
   4. At Intersections of two vertical surfaces, extend the first ply at least 250 mm (10 inches) on each side of the intersection.
   5. The second ply shall lap the first by not less than 50 mm (two inches).

D. Keyed Joint Footings:

1. Provide an asphaltic-coated 454 g (16-ounce) cold-rolled copper flashing sheet with joints soldered and neatly formed to the contours of keyed joints in foundation wall footings.
2. The flashing sheet shall extend a minimum of 250 mm (10 inches) beyond the inside edge of the footing and shall be bent down 100 mm (4 inches) on the outside of the footing.
3. Protect the flashing sheet until it is lapped by the waterproofing membranes for the subsurface floor slabs and foundation walls.

E. Flashing Flanges:
1. Prime flashing flanges of the sleeves of pipe and ducts penetrating the waterproofing membrane.
2. Allow primer to dry and strip flanges in with two fabric membrane collars cemented in place and to each other with bituminous plastic cement. The collars shall extend 100 mm and 150 mm (four and six inches), respectively, beyond the edge of the flanges, cover the flanges, and fit tight against the sleeve.
3. Waterproofing connecting with work exposed to the weather shall extend back of same, or be counter-flashed to form a watertight connection.

F. Clamping Devices:
1. At floor drains and elsewhere as indicated, extend membrane into clamping device set in heavy coating of bituminous roof cement and clamp securely.

G. Reglets:
1. Where indicated, install continuous reglets as specified in Section, 07 60 00, FLASHING AND SHEET METAL, to receive the exposed edges of membrane waterproofing.
2. After placement of waterproofing, completely fill reglets with bitumen.

H. Wood Nailers:
1. Where indicated, upper edges of membrane waterproofing shall be nailed to wood nailers and covered with two plies of fabric reinforcement.

3.4 PROTECTIVE COVERING:

A. Fiberboard Protection of Waterproofing on Walls:
1. Install 13 mm (1/2-inch) thick fiberboard for protection of exterior membrane waterproofing walls and footings below grade.
2. Fiberboard shall extend full height of backfill.
3. Mop a coat of hot pitch or asphalt over membrane sufficient for installation of one piece of fiberboard and embed board therein.
4. Assure overall contact on vertical surfaces by use of a wooden mallet.
5. Repeat the operation in adjoining areas until protection is complete.
6. Adjoining boards shall have edges in moderate contact.
7. After protection boards are in place, mop exposed surfaces with hot pitch or asphalt, and fill joints.

B. Horizontal Surfaces: As soon as the application has thoroughly dried, apply protective cement topping specified under Section 03 30 00, CAST-IN-PLACE CONCRETE.

3.5 INSPECTION:

A. Do not cover waterproofed surfaces by other materials or backfill until the work is approved by Resident Engineer.

END OF SECTION

SECTION 07 13 00
SHEET WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies sheet waterproofing materials used for shower pan waterproofing in personnel showers.

1.2 QUALITY CONTROL

A. Approval by the Resident Engineer is required of products of proposed manufacturers.

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. Sheet waterproofing.
   2. Printed installation instructions.

C. Certificates:
   1. Sheet waterproofing manufacturer's approval of adhesive used.
   2. Waterproofing tests report indicating that water test as specified has been made for each shower area and that each area was found to be watertight.

D. Samples:
   1. Sheet waterproofing, 150 mm (6 inches) square.
   2. Waterproofed building paper, 150 mm^2 (6 inches square).
   3. Adhesive, 0.24 L (1/2 pint).

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job in manufacturer's original unopened containers with brand name marked thereon.

B. Unload and store so as to prevent injury to materials.

C. Do not store material in areas where temperature is lower than 10°C (50°F), or where prolonged temperature is above 32°C (90°F).

1.5 WARRANTY

A. Shower pan waterproofing is subject to the terms of Article titled "Warranty of Construction", FAR clause 52.246-21, except that warranty period is extended to two years.

1.6 APPLICABLE PUBLICATIONS:

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

B. Federal Specification (Fed. Spec.):

UU-B-790A INT AMD	Building Paper, Vegetable Fiber: (Kraft, Waterproof, Water Repellent and Fire Resistant)

PART 2 - PRODUCTS

2.1 SHOWER PAN WATERPROOFING SHEET

A. Rubber type sheet formed of non-reinforced, homogeneous, impermeable, sheeting compound reduced to thermoplastic state, resistant to fungus, mildew and bacteria, not less than 1.5 mm (60 mils) thick.

B. Asphaltic sheet formed with a laminated asphalt construction consisting of eight plies of Kraft paper bonded and saturated by seven layers of asphalt, reinforced with three layers of glass fibers and faced with polyethylene sheet; total weight 1.9 kg/m^2 (0.40 pounds per square foot).

2.2 ADHESIVES

A. As furnished by the manufacturer of the sheet waterproofing.

B. Compatible with adjacent materials where contact occurs.

2.3 WATERPROOFED BUILDING PAPER

A. Fed. Spec. UU-B-790, Type I, Grade C.

2.4 CONCRETE PATCHING COMPOUND

A. Portland cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors.

B. Have not less than the following physical properties:
   1. Compressive strength - 25 mPa (3500 psi).
   2. Tensile strength - 7 mPa (1000 psi).
   3. Flexural strength - 7 mPa (1000 psi).
   4. Density - 1.9.

C. Capable of being applied in layers up to 50 mm (two inches) thick, being brought to a feather edge, and being troweled to a smooth finish.

D. Ready for use in 48 hours after application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installing shower pan waterproofing, adjoining surfaces shall be clean, smooth, firm and dry.

B. Concrete surfaces shall be cured a minimum of seven days and be free from release agents, concrete curing agents, and other contaminates.

C. Remove all high spots and loose and foreign particles and fill all voids, depressions joints and cracks with concrete patching compound.

D. Ensure vertical surfaces have a continuous supportive back substrate for waterproofing.

3.2 INSTALLATION

A. Coat entire surfaces to receive shower pan waterproofing with adhesive spread at rate of 1 L/m^2 (one gallon per 40 square feet).

B. Butt joints and cover with a strip of the waterproofing sheeting material eight inches in width and seal with adhesive.

C. Carry sheeting up vertical surfaces not less than 4 inches above surface of shower floor. Carry over tops of curbs.

D. Roll entire horizontal surfaces with 23 to 45 kg (50 to 100 pounds) roller and roll corners and vertical sections with a rubber roller to insure solid anchorage.

E. Make cut out for floor drains and fit to drain for watertight assembly, coordinating with drain installation.

3.3 PROTECTION

A. When finish floor will not be immediately installed, protect waterproofing pan.

B. Cover with 2 inches of sand or waterproofed building paper.

C. Maintain protection until finished floor is placed.

3.4 WATER TEST

A. Test in presence of Resident Engineer for leaks before permanent finish is applied over shower pan waterproofing.

B. Seal floor drain watertight and fill waterproofing pan with water to within approximately 25 mm (1 inch) of top of its vertical surfaces.

C. When leakage occurs, repair waterproofing and repeat testing until no leakage occurs.

D. Submit certificate to Resident Engineer of test results.

END OF SECTION

SECTION 07 13 26.01.01
SELF-ADHERING SHEET MEMBRANE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Self-Adhering Sheet Membrane Waterproofing, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Apply waterproofing to:
   1. Exterior of walls below grade including exterior of walls surrounding elevator pits and other areas having lowered floor slabs.

B. Comply with all ASTM Standards noted.

C. Applicator qualifications:
   1. Not less than five (5) similar sized projects with material specified.
   2. Approved in writing by waterproofing manufacturer.

1.3 PRE-INSTALLATION MEETING

A. Hold pre-installation meeting directed by Construction Manager prior to beginning of waterproofing, to discuss following:

B. Hold pre-installation meeting directed by Contractor prior to beginning of waterproofing to discuss following:
   1. Extent of waterproofing.
   2. Substrate conditions, preparation, pretreatment and curing periods.
   3. Review of special details, flashings, termination provisions, specifications, application requirements, and preparatory work.
   4. Installation procedures and schedule.

C. Attendance is recommended for:
   Contractor.
   1. Installer's superintendent.
   2. Manufacturer's representative.
   3. Supervisors of other trades whose work may effect, or come in contact with, waterproofing system.

   Minimum two weeks prior to pre-construction meeting, forward following to Contractor for review:
   Installation drawings.
   Manufacturer's product data.
   Other information deemed pertinent for sound and secure application.

1.4 SUBMITTALS

A. Product data:
   1. Manufacturer's standard catalog cut sheets indicating product in accordance with specifications.

B. Project information:
   1. Manufacturer certification of installer qualifications.
   2. Product test reports from qualified independent testing agency evidencing compliance of waterproofing with physical properties and other requirements based on comprehensive testing in accordance with specified test methods within previous 5 years.
   3. Minutes of Pre-Installation Meeting.

C. Contract closeout information:
   1. Warranty.

1.5 WARRANTY

A. Provide written five (5) year warranty signed jointly by installer and manufacturer to include waterproof integrity, adhesion to substrate and surface degradation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Waterproofing system:
   1. Base:
      a. Carlisle Coatings and Waterproofing Incorporated.
   2. Optional:
      a. Grace Construction Products.
      b. Polyguard Products, Inc.
      c. W. R. Meadows.

B. Or Approved Equal.

2.2 MATERIALS

A. Waterproofing system:
   1. Self-adhesive rubberized asphalt composite sheet membrane:
      a. Total minimum thickness: 60 mil thick, composite sheet consisting of:
         1) Minimum 56 mil thick rubberized asphalt membrane laminated to;
         2) Minimum 4 mil thick cross-laminated polyethylene film with release liner on adhesive side.
      b. Base Product: CCW MiraDRI 860/861.
   2. Sheet shall be formulated for use with ambient and substrate temperatures at time of installation, and for use with primer or surface conditioner complying with VOC limits of authorities having jurisdiction.
   3. Provide waterproofing complying with following physical properties:
      a. Membrane Tensile strength: Minimum 325 PSI; ASTM-D412.
      b. Ultimate elongation: Minimum 300 percent; ASTM-D412.
      c. Low Temperature Pliability: No effect when tested in accordance with ASTM-C836 or ASTM-D146.
      d. Membrane Puncture Resistance: Minimum 50 LBS; ASTM-E154.
      e. Peel Adhesion, concrete: 7 LBS/IN when tested in accordance with ASTM-D903or ASTM-D1000.
      f. Lap Adhesion, membrane: 5 LB/IN when tested in accordance with ASTM-D1876 or D1000.
      g. Vapor Transmission, Maximum Permeance: 0.05 Perms.
      h. Water absorption: Maximum 0.10 percent when tested in accordance with ASTM-D570 or ASTM-D1970.
      i. Hydrostatic-head resistance: Minimum FT; ASTM-D751.

4. Surface Primer:
   a. CCW liquid primer recommended by manufacturer of sheet waterproofing material for substrate and application temperatures.
5. Sheet flashing:
   a. Self-adhering, polymer-modified rubberized-asphalt composite sheet of same material, construction, and thickness as waterproofing sheet membrane.
6. Liquid membrane:
   a. Elastomeric, 2-component, liquid, cold fluid-applied, trowel grade, or low viscosity as recommended by waterproofing manufacturer for application.
7. Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
8. Penetration seal:
   a. Self-adhering reinforced membrane, 2-1/2 IN wide, with a tack-free protective adhesive coating on 1 side and a release film on self-adhering side.

C. Drainage Composite panels:
1. Composite 3-dimensional non-biodegradable panels with permeable geotextile bonded to dimpled, molded plastic drainage core designed to effectively convey water:
   a. Geotextile: Non-woven or woven fabric of polypropylene or polyester fibers, or combination of both.
   b. Select geotextile fabric porosity as recommended for soil/backfill that will be encountered on project.
2. Vertical Applications:
   a. CCW MiraDRAIN 6200:
      1) Material Thickness: 0.40 IN (7/16 IN nominal); ASTM-D1777.
      2) Compressive strength: 15,000 PSF, (104 PSI); ASTM-D1621
      3) Core Flow Rate (installed vertically): 12.5 GPM/FT of width; ASTM-D4716.
3. Approved by the waterproofing manufacturer for the intended use and compatibility with the waterproofing system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cure concrete to moisture content acceptable to waterproofing manufacturer.
   1. Verify substrate is visibly dry and free of moisture.
   2. Test for capillary moisture by plastic sheet method according to ASTM-D4263.

B. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

C. Clean, prepare and treat substrate according to manufacturer's written instructions, to provide clean, dust-free, and dry substrate for waterproofing application.

D. Mask off adjoining surfaces not receiving waterproofing to prevent spillage affecting other construction.

E. Prime as recommended by manufacturer.

F. Install in accordance with manufacturers instructions.

3.2 MEMBRANE INSTALLATION – PENETRATION, TRANSITION AND TERMINATION DETAILS

A. Construction joint, control joints, cracks and voids exceeding 1.6 mm 1/16 IN: Fill with liquid membrane and install 203 mm 8 IN membrane strip.

B. Expansion joints: Where anticipated movement is less than 13 mm 1/2 IN, install 3-ply membrane system as recommended by manufacturer.

C. Vertical Inside and Outside Corners: Prepare, prime, and treat inside corners according to waterproofing manufacturer's instructions:
   1. Install 12 IN membrane strip centered over vertical corners.

D. Horizontal Inside corners including foundation wall to footing intersections: Prepare, prime, and treat inside corners according to waterproofing manufacturer's instructions:
   1. Install 3/4 IN fillets of liquid membrane.
   2. Extend liquid membrane each direction from corner or install membrane strip centered over corner.

E. Horizontal outside corners: Prepare and treat outside corners according to waterproofing manufacturer's instructions.
   1. Apply double layer overlapping membranes.

F. Drains:
   1. Apply a double layer of membrane extending 12 IN beyond drain.
   2. Install field sheet centered over drain.

G. Pipes, posts, conduits, and similar penetrations:
   1. Apply a double layer of membrane extending out at least 6 IN from the penetrating item in all directions.
   2. Seal with mastic or liquid membrane product.
   3. Coordinate detailing at penetrations made after waterproofing system is complete with subcontractors responsible for penetrations.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at protrusions according to waterproofing manufacturer's instructions.
   1. At top of wall conditions: Terminate membrane below final grade.
      a. Apply mastic to terminations and joints.

3.3 SELF-ADHERING COMPOSITE SHEET APPLICATION

A. Install self-adhering composite sheet according to waterproofing manufacturer's written instructions.

B. Apply primer to substrate at required rate and allow to dry:
   1. Limit priming to areas that will be covered by waterproofing membrane in same day.
   2. Re-prime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheet membrane over area to receive waterproofing:
   1. Accurately align sheets and maintain uniform 2-1/2 IN minimum lap widths and end laps.
   2. Overlap and seal seams and stagger end laps to ensure watertight installation.
   3. Roll laps of membrane installed on vertical surfaces, and roll membrane on sloping and horizontal surfaces.

D. Apply continuous sheet membrane over membrane strips bridging each type of joint to dimensions required by manufacturer.

E. Seal exposed edges of membrane terminations.

F. Install sheet membrane and auxiliary materials to tie in adjacent waterproofing.

G. Repair tears, voids, and lapped seams in waterproofing not meeting requirements:
   1. Slit and flatten fishmouths and blisters.
   2. Patch with sheet membrane extending 6 IN beyond repaired areas.

H. Waterproofing Membrane must not be left exposed to construction traffic or ultraviolet rays for a period exceeding 10 days without protection.

3.4 DRAINAGE PANEL INSTALLATION

A. Place and secure drainage panels according to manufacturer's written instructions.

B. Use adhesives and mechanical fasteners recommended by manufacturer and that do not penetrate waterproofing.

C. Do not penetrate waterproofing, and do not use stick clips to install protection course.

D. Lap edges and ends of geotextile to maintain continuity.

E. Protect installed panels during subsequent construction.

F. Adhesively attach drainage board at top-of-wall termination.
   1. Hold top of composite drainage board 6 IN below finish grade.
   2. Fold fabric over and tuck into wall in such a way that will avoid intrusion of backfill material in to the drainage channels.

3.5 PROTECTING AND CLEANING

A. Protect waterproofing from damage and wear during application and remainder of construction period, according to manufacturer's written instructions.

B. Protect installed system from damage due to ultraviolet light exposure, physical abuse, and other causes.
   1. Provide temporary coverings where system will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 13 52
MODIFIED BITUMINOUS SHEET WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies modified bituminous sheet material used for exterior below grade waterproofing and split slab waterproofing.

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. 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.

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:

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

1.6 WARRANTY:

A. Warrant bituminous sheet waterproofing installation against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period is two years.

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 INT AMD 1 Building Paper, Vegetable Fiber: (Kraft, Water-Proof, Water Repellent and Fire Resistant)

C. American Society for Testing and Materials (ASTM):
   C578-07 Rigid Cellular Polystyrene Thermal Insulation
   D41-05 Asphalt Primer Used in Roofing, Dampproofing and Waterproofing
   D2822-05 Asphalt Roof Cement
   D6380-03 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. 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 contaminates.

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:

F. 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:

A. 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 Resident Engineer, that water tests have been made and that areas tested were found watertight.

3.6 INSPECTION:

A. Do not cover waterproofed surfaces by other materials or backfill until work is approved by Resident Engineer.

END OF SECTION

SECTION 07 21 00.01
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Building Insulation, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Comply with the following reference standards:
   1. Underwriters Laboratories Inc.
   2. ASTM-C518. Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   3. ASTM-C739. Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation.
   4. ASTM-E84. Standard Test Method for Surface Burning Characteristics of Building Materials.
   5. ASTM-E90. Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   6. ASTM-E119. Standard Test Methods for Fire Tests of Building Construction and Materials.
   7. ASTM-E136. Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

B. Insulation value exterior walls: R-13 or R-3.8 continuous insulation.

1.3 SUBMITTALS

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

B. Project Information:
   1. Manufacturer's literature & data of listed products.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Rigid Board Insulation Extruded Polystyrene (XPS):
   1. Base:
      a. Dow Chemical.
   2. Optional:
      a. Pactiv Building Products (GreenGuard).
      b. Owens-Corning.

B. Other Materials:
   1. Base:
      a. As indicated.

C. Or Approved Equal.

2.2 MATERIALS

A. Rigid Board Insulation - Extruded Polystyrene (XPS):
   1. Foamed, extruded polystyrene complying with ASTM-C575.
   2. Minimum Compressive Strength:
      a. 25 PSI.
   3. Minimum Surface Burning Characteristics (per ASTM-E84):
      a. Flame Spread: less than 75.
      b. Smoke Developed: less than 450.
   4. Water vapor permanence for 1 IN product: 1.00 perm, maximum.
   5. Water absorption: Maximum 0.15 percent.
   6. Thermal resistance: , R-value of 5.0 per inch at 75 degF mean temperature.
   7. Integral high density skin.
   8. Base Products: Styrofoam, GreenGuard, or Foamular; or approved equal.
   9. Minimum thickness:
      a. 2 IN.
      b. Other thicknesses as indicated or required.
   10. Adhesives for adhering polystyrene insulation: As recommended by insulation manufacturer.

B. Insulated Drainage Board:
   1. Adhesives for adhering polystyrene insulation: As recommended by insulation manufacturer.

C. Unfaced Fiberglass Batt Insulation:
   1. Inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets.
   2. Un-faced, Type I in accordance with ASTM-C665.
   3. Minimum Surface Burning Characteristics (per ASTM-E84): Flame Spread: <25; Smoke Developed: <50.
   4. Combustion characteristics: Noncombustible; unfaced per ASTM-E136.

Thickness	R-Valve
3-5/8”	R-13
6-1/2”	R-19
8-1/4”	R-25
10-1/4”	R-30
13”	R-38

   5. Nominal Thickness / Thermal Resistance Value, measured at 75 DegF:
      a. Nominal Thickness: 6-1/2 IN / R-19.
      b. Nominal Thickness: 13 IN / R-38.

D. Rigid Fiber Insulation:
   1. Unfaced, non-combustible, water repellant, semi-rigid mineral wool insulation board.
   2. Foil-faced, non-combustible, water repellant, semi-rigid mineral wool insulation board.
      a. Tape seams with vapor retarder tape.
   3. Temperature Resistance: Per ASTM C 612.
      a. Over 1094 degC 2000 degF.
   4. Surface Burning Characteristics: Per ASTM E84.

a. Flame Spread: 25.
b. Smoke Developed: 0.
5. Moisture Resistance: Absorbs less 0.03% by volume, per ASTM C 1104.
6. R-value of 4.2 per inch.
7. Density: 4.5 PCF.
8. Non-corrosive per ASTM C 665.
9. Thickness: As noted in drawings.
10. Base manufacturer: Thermafiber RainBarrier 45 Insulation.
11. Optional manufacturer: Roxul CavityRock MD and DD; or approved equal.
12. Mechanical fasteners:
    a. Pronged hangers and slotted washers, or arrow pointed hangers.
    b. Sized to fit rigid fiber insulation thickness.
    c. Base: GEMCO, Goodloe E. Moore: Gemco pronged hanger with WP washer.
    d. Optional: Stic-Klip Manufacturing; or approved equal.
13. Mastic for use with mechanical fasteners:
    a. Base Product: GEMCO as manufactured by Goodloe E. Moore; or approved equal.
14. Waterproof coating:
    a. Portland cement-based waterproof coating:
        1) Base Product: Thoroseal as manufactured by ChemRex Inc; or approved equal.
        2) Apply with complete coverage inside face of architectural precast concrete panels filling all voids and pits, and creating a smooth substrate for installation of impaling clips, and rigid fiber insulation.
        3) Apply with complete coverage inside face of site cast concrete panels filling all voids and pits, and creating a smooth substrate for installation of impaling clips and rigid fiber insulation.
    b. Admixture:
        1) Base Product: ACRYL 60 as manufactured by ChemRex Inc; or approved equal.
        2) Water-based acrylic-polymer bonding and modifying admixture to be mixed with Thoroseal to enhance physical properties, adhesion to substrates, and durability.

E. Vapor Retarder (VR):
1. 5-ply, linear low density polyethylene film.
2. Dual scrim-reinforced.
3. Permeance: Not exceeding 0.053 Perm (US).
4. Surface Burning Characteristics:
    a. Class 1 / Class A per ASTM-E84.
    b. Maximum Flame Spread: 5.
    c. Maximum Smoke Developed: 135.
5. Base Product: Type 90 FR by Griffolyn.
6. Optional Product: R-3035HD by Lamtec; or approved equal.
7. Seaming Tape:
    a. Self-adhering, asphaltic mastic.
    b. Base Product: Fab Tape by Griffolyn.
    c. Optional Product: 491 FSK by Ideal, or similar product as recommended by Fortifiber for its FSK vapor retarder; or approved equal.
8. Repair Tape, for punctures and other damaged areas:
    a. Base Product: Griff Tape by Griffolyn.
    b. Optional Products: Same products listed for optional seaming tapes; or approved equal.

F. Sheet metal vapor retarder:
1. Minimum 24 GA galvanized steel sheet metal.
    a. Continuous taping flange.
    b. Size: As required.
    c. Profile: As required.

2. Provide at interface of vapor retarder and steel structure adjacent to the exterior wall.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Installation indicates acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

A. Insulate full thickness over surfaces to be insulated.

B. Fit tightly around obstructions, fill voids.

C. Cover penetrations with insulation.

D. Seal joints with sealant or tape as applicable.

E. Seal or tape to abutting materials to maintain vapor tightness.

F. Install vapor retarder over exposed insulation.

G. Comply with manufacturer's instructions for installation unless more stringent requirements are specified.

H. If manufacturer's instructions are not available, or not applicable, consult manufacturer's technical representative for specific recommendations prior to installation.

I. Apply rigid insulation in double layer with staggered joints to achieve total thickness.

J. Do not use broken or torn pieces of insulation.

K. Install so completed installation is vapor tight.

L. Repair areas as required to insure vapor tight integrity.

M. Do not allow foam type insulation to remain exposed to inside of building.

N. Provide minimum cover of 1/2 IN gypsum wallboard over exposed foam surfaces.

3.3 INSTALLATION – UN-FACED BATT INSULATION AND VAPOR RETARDER IN EXTERIOR STUD WALL SYSTEMS

A. General:
   1. This Article describes a system of un-faced fiber glass batts which are friction-fit between the stud framing members, and a subsequent installation of sheet vapor retarder over the face of framing.
      a. Batts which are pre-faced with Vapor Retarder are not acceptable.
   2. Position vapor retarder over "inside" face of framing.

B. Installing Batts:
   1. Friction fit un-faced batts between studs.
   2. Tightly butt ends.
   3. Where specified thickness of batts is less than the depth of framing: Install mechanical devices to prevent sagging.

C. Installing Vapor Retarder:
   1. Install vapor retarder in 50 IN wide sheets.

2. Install vapor retarder verticallyInstall in continuous sheets, floor to structure above, without horizontal joints.
4. Vertical Seams:
   a. Tape vertical edge of vapor retarder to stud.
   b. Position subsequent adjoining sheet and continuously tape vertical edge to preceding sheet.
5. Tape bottom and top edges to structure continuously.

D. Sealing Vapor Retarder to Sheet Metal Vapor Retarder (Continuous Taping Flange):
1. Include the following where wall adjoins steel columns, spandrel beams and similar structural steel members, and where indicated.
2. Install Sheet Metal Vapor Barrier (continuous taping flange) to flange of structural steel members prior to application of fireproofing.
   a. Seal to structure with urethane sealant and mechanical fasteners.
   b. Protect flange with masking tape to prevent accumulation of fireproofing over-spray.
   c. Remove masking tape after fireproofing application.
3. Prior to installation of Vapor Retarder Tape: Clean taping flange to remove oily residue and remaining fireproofing over-spray (if present).
4. Continuously tape vapor retarder to previously installed taping flange.
   a. Seal vapor retarder to taping flange continuously, using Vapor Retarder Tape specified.
   b. Optional: Continuous clips (Trim-Tex Finish Trim #3910) may be used in lieu of tape.

E. Sealing Vapor Retarder at other areas of discontinuity:
1. Prior to installation of gypsum wallboard or other covering:
   a. Repair tears, flaw in seams and terminations with vapor retarder tape.
   b. Seal Vapor Retarder to conduit, electrical boxes, piping and other penetrating items using vapor retarder tape.

F. Continuously seal or tape vapor retarder sheets to abutting materials and penetrations such as windows, doors, conduit, boxes, pipes or other items to maintain vapor tightness.

G. Continuously seal all joints or voids in abutting materials and penetrations with sealant or tape as applicable to provide continuous vapor tightness.

3.4 INSTALLATION - RIGID BOARD (XPS) INSULATION

A. Do not proceed with installation until subsequent work which conceals insulation is ready to be performed.

B. Extend insulation full thickness in one layer over entire area to be insulated.

C. Adhere insulation to wall per insulation manufacturer's recommendations.

D. Press courses of insulation with edges butted tightly both ways.

E. Calk and tape joints.

3.5 INSTALLATION - RIGID BOARD INSULATION (XPS) AT FOUNDATIONS

A. General:
1. Install XPS insulation at foundation at building perimeter.
2. Install both at vertically at foundation.
3. Minimum Thickness (unless otherwise indicated): 2 IN.

B. Foundation Insulation, vertical:
1. Install insulation underground inside or outside foundation walls.
2. Extend down for distance indicated in one layer
   a. If not indicated, extend down to design frost line.

3. Install in mastic with tight joints on walls.
4. Protect from damage and/or displacement during backfilling.
5. Do not apply to exterior portions of foundation that will be exposed to view.

END OF SECTION

SECTION 07 21 13
THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies thermal and acoustical insulation for buildings.

B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

1.2 RELATED WORK

A. Insulation in connection with roofing and waterproofing: Section 07 22 00, ROOF AND DECK INSULATION.

B. Safing insulation: Section 07 84 00, FIRESTOPPING.

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data:
   1. Insulation, each type used
   2. Adhesive, each type used.
   3. Tape

C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

1.4 STORAGE AND HANDLING

A. Store insulation materials in weathertight enclosure.

B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

1.5 APPLICABLE PUBLICATIONS

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

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

C516-08	Vermiculite Loose Fill Thermal Insulation
C549-06	Perlite Loose Fill Insulation
C552-07	Cellular Glass Thermal Insulation.
C553-08	Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
C578-08	Rigid, Cellular Polystyrene Thermal Insulation
C591-08	Unfaced Preformed Rigid Cellular Polyisocynurate Thermal Insulation
C612-04	Mineral Fiber Block and Board Thermal Insulation
C665-06	Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
C728-05	Perlite Thermal Insulation Board

C954-07	Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Base to Steel Studs From 0.033 (0.84 mm) inch 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 Steel Studs
D312-00(R2006)	Asphalt Used in Roofing
E84-08	Surface Burning Characteristics of Building Materials
F1667-05	Driven Fasteners: Nails, Spikes and Staples.

PART 2 - PRODUCTS

2.1 INSULATION – GENERAL

A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.

B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.

C. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.

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

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Phenolic rigid foam	5 percent recovered material
Rock wool material	75 percent recovered material

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

2.2 PERIMETER INSULATION IN CONTACT WITH SOIL

A. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX where covered by soil or concrete.

B. Cellular Glass Block: ASTM C552, Type I or IV.

2.3 EXTERIOR FRAMING OR FURRING INSULATION

A. Batt or Blanket: Optional.

B. Mineral Fiber: ASTM C665, Type II, Class C, Category I where framing is faced with gypsum board.

C. Mineral Fiber: ASTM C665, Type III, Class A where framing is not faced with gypsum board.

2.4 ACOUSTICAL INSULATION

A. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semirigid (4.5 pound nominal density).

B. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.

C. Thickness as shown; of widths and lengths to fit tight against framing.

2.5 RIGID INSULATION

A. On the inside face of exterior walls, spandrel beams, floors, bottom of slabs, and where shown.

B. Mineral Fiber Board: ASTM C612, Type IB or 2.

C. Perlite Board: ASTM C728.

D. Cellular Glass Block: ASTM C552, Type I.

2.6 ADHESIVE

A. As recommended by the manufacturer of the insulation.

B. Asphalt: ASTM D312, Type III or IV.

C. Mortar: ASTM C270, Type 0.

2.7 TAPE

A. Pressure sensitive adhesive on one face.

B. Perm rating of not more than 0.50.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.

B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.

C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.

D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

3.2 PERIMETER INSULATION:

A. Vertical insulation:
   1. Fill joints of insulation with same material used for bonding.
   2. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
   3. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.

B. Horizontal insulation under concrete floor slab:
   1. Lay insulation boards and blocks horizontally on level, compacted and drained fill.
   2. Extend insulation from foundation walls towards center of building not less than 600 mm (24 inches) or as shown.

3.3 EXTERIOR FRAMING OR FURRING BLANKET INSULATION:

A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.

B. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.

C. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.

D. Fasten blanket insulation between wood studs or framing with nails or staples through flanged edges on face of stud. Space fastenings not more than 150 mm (six inches) apart.

E. Roof Rafter Insulation or Floor Joist Insulation: Place mineral fiber blankets between framing to provide not less than a 50 mm (two inch) air space between insulation and roof sheathing or subfloor.

F. Ceiling Insulation and Soffit Insulation:
   1. Fasten blanket insulation between wood framing or joist with nails or staples through flanged edges of insulation.
   2. At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing. Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.
   3. In areas where suspended ceilings adjoin areas without suspended ceilings, install either blanket, batt, or mineral fiberboard extending from the suspended ceiling to underside of deck or slab above. Secure in place to prevent collapse or separation of hung blanket, batt, or board insulation and maintain in vertical position. Secure blanket or batt with continuous cleats to structure above.

3.4 RIGID INSULATION ON SURFACE OF EXTERIOR WALLS, FLOORS, AND UNDERSIDE OF FLOORS:

A. On the interior face of solid masonry and concrete walls, beams, beam soffits, underside of floors, and to the face of studs for interior wall finish where shown.

B. Bond to solid vertical surfaces with adhesive as recommended by insulation manufacturer. Fill joints with adhesive cement.

C. Use impaling pins for attachment to underside of horizontal surfaces. Space fastenings as required to hold insulation in place and prevent sagging.

D. Fasten board insulation to face of studs with screws, nails or staples. Space fastenings not more than 300 mm (12 inches) apart. Stagger fasteners at joints of boards. Install at each corner.

E. Floor insulation:
   1. Bond insulation to concrete floors in attic by coating surfaces with hot steep asphalt applied at rate of not less than 11.5 Kg per m² (25 lbs/100 sq. ft.), and firmly bed insulation therein.
   2. When applied in more than one layer, bed succeeding layers in hot steep asphalt applied at the rate of not less than 11.5 Kg per m² per m² lbs/100 sq. ft.).
   3. Contractors option: Insulation may be installed with nonflammable adhesive in accordance with the manufacturer's printed instructions when a separate vapor retarder is used.

3.5 ACOUSTICAL INSULATION:

A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.

B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.

C. Do not compress insulation below required thickness except where embedded items prevent required thickness.

D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.

E. Where semirigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedments in insulation.

F. Where sound deadening board is shown, secure with adhesive to masonry or concrete walls and with screws to metal framing . Secure sufficiently in place until subsequent cover is installed. Seal all cracks with caulking.

END OF SECTION

SECTION 07 22 00
ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Installation of roof and deck insulation, and vapor retarder on new construction ready to receive roofing or waterproof membrane.

B. Repairs and alteration work to existing roof insulation.

1.2 RELATED WORK

A. Perimeter, rigid, and batt or blanket insulation: Section 07 21 13, THERMAL INSULATION.

B. Sheet metal components: Section 07 60 00, FLASHING AND SHEET METAL.

1.3 QUALITY CONTROL

A. Supervision of work by persons that are knowledgeable and experienced in roofing. See submittals for documentation of supervisor's qualification.

B. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.

1.4 SUBMITTALS

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

B. Manufacturer's Literature and Data:
   1. Asphalt materials, each type
   2. Roofing cement, each type
   3. Roof insulation, each type
   4. Fastening requirements
   5. Insulation span data for flutes of metal decks

C. Samples:
   1. Roof insulation, each type
   2. Nails and fasteners, each type

D. Certificates:
   1. Indicating type, thickness and thermal conductance of insulation. (Average thickness for tapered insulation).
   2. Indicating materials and method of application of insulation system on metal decks meet the requirements of Factory Mutual Research Corporation for Class 1 Insulated Steel Deck Roofs.

E. Laboratory Test Reports: Thermal values of insulation products.

F. Layout of tapered roof system showing units required.

G. Documentation of supervisors training and experience showing knowledge of roofing procedures.

1.5 DELIVERY, STORAGE AND MARKING

A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.

B. Keep materials dry, and store in dry, weathertight facilities or under canvas tarps. Use of polyethylene or plastic tarps to cover materials is not permitted. Store above ground or deck level on wood pallets. Cover ground under stored materials with plastic tarp.
   1. Store rolled materials (felts, base sheets, paper) on end. Do not store materials on top of rolled material.
   2. Store foam insulation away from areas where welding is being performed and where contact with open flames is possible.

C. Protect from damage from handling, weather and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

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

B. Federal Specifications (Fed. Spec.):

UU-B-790A	Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

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

C208-08	Cellulosic Fiber Insulating Board
C209-07	Test Methods for Cellulosic Fiber Insulating Board
C552-07	Cellular Glass Thermal Insulation
C726-05	Mineral Fiber Roof Insulation Board
C728-05	Perlite Thermal Insulation Board
C1289-07	Faced Rigid Cellular Polyisocynurate Thermal Insulation Board
D41-05	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D312-00(R2006)	Asphalt Used in Roofing
D2178-04	Asphalt Glass Felt Used in Roofing and Waterproofing
D2822-05	Asphalt Roof Cement
F1667-05	Driven Fasteners: Nails, Spikes, and Staples

D. Factory Mutual Global (FM):

1-28	Winds Loads to Roof Systems and Roof Deck Securement
P7825-05	Approval Guide

E. National Roofing Contractors Association (NRCA):
The NRCA Roofing Manual 2009

F. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory (2009)

G. U.S. Department of Commerce (NBS):

PS 1-07	Structural Plywood

H. National Particleboard Association (NPA):

A208.1-93	Mat-Formed Wood Particleboard

1.7 **QUALITY ASSURANCE**

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 E 84. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM P7825. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

PART 2 - PRODUCTS

2.1 **ASPHALT MATERIALS**

A. Primer: ASTM D41.

B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.

C. Glass (Felt): ASTM D2178, Type IV, heavy duty ply sheet.

D. Venting Asphalt Base Sheet: ASTM D3672, Type I or Type II.

E. Roof Cement: ASTM D2822, Type I or Type II, asbestos free; or, D4586, Type I or Type II.

2.2 **INSULATION**

A. Cellular Glass: ASTM C552, Type IV, roof board.

B. Mineral Fiberboard: ASTM C726.

C. Perlite Board: ASTM C728.

D. Isocyanurate Board: ASTM C1289, Type I, Class 2 or Type III.

E. Cellulosic Fiberboard: ASTM C208, Type II, Grade 1 for built-up roofs; Grade 2 for single-ply roofing.

F. Nail base insulating board:
   1. Top surface not less than 10 mm (3/8 inch) thick plywood, waferboard or wood particleboard nail base surface.
      a. Plywood: NBS PS 1, Exposure 1.
      b. Particleboard: ANSI A208.1, Type 1 Grade 1-M-2 or Type 2, Grade 2-M-2.
   2. Insulation: Isocyanurate or urethane conforming to material specifications.
   3. Bottom surface faced with felt facers.

G. Tapered Roof Insulation System Segments:
   1. Fabricate of mineral fiberboard, isocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections.
   2. Cut to provide high and low points with crickets and slopes as shown.
   3. Minimum thickness of tapered sections; 13 mm (1/2 inch), unless manufacturers allow taper to zero mm (inch).

2.3 **MISCELLANEOUS**

A. Building Paper (Sheathing Paper):
   1. Fed. Spec. UU-B-790, Type I, Barrier paper, Grade D, Water - Vapor permeable, Style 1a, Uncreped, not reinforced; or, Style 1b, Uncreped, not reinforced, red rosin sized.

2. Weighing approximately 3 kg/10 m^2 (six pounds per 100 square feet).

B. Tapered Edge Strips:
1. Tapered 1:12 (one inch per foot), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
2. Cellulosic Fiberboard: ASTM C208.
3. Mineral Fiberboard: ASTM C726.
4. Perlite Board: ASTM C728.

2.4 FASTENERS

A. Staples and Nails: ASTM F1667. Type as designated for item anchored and for substrate.

B. Nails for securing base sheets, and first ply of vapor retarder, to wood nailers and deck:
1. Type I, Style 20, zinc coated steel roofing nails with minimum head diameter of 10 mm (3/8 inch) through metal discs at least 25 mm (one inch) across; or,
2. One piece nails with an integral flat cap at least 24 mm (15/16 inch) across.

C. Nails for securing building paper and dry felt edge strips to wood nailer and decks:
1. Type I, Style 20, zinc coated steel roofing nails, 16 mm (5/8 inch) minimum head diameter.
2. Type IV, staples, Style 3, flat top crown, zinc coated may be used.

D. Nails into plywood: Annular thread type of length to provide at least 19 mm (3/4 inch) penetration.

E. Nails for securing venting base sheet to insulating concrete:
1. Self-clinching type of galvanized steel having an integral flat cap at least 25 mm (one inch) across.
2. Nails shall have a holding power of not less than 27 kg (60 pounds) when pulled from 11.7 kg (25.8 pounds) density insulating concrete.

F. Nails for securing base sheet, building paper, or first ply of vapor retarder to structural wood fiber decks:
1. Self-clinching type having an integral flat cap not less than 25 mm (one inch) across.
2. Nails shall have a holding power of not less than 18 kg (40 pounds) per fastener.

G. Nails for securing insulation venting base sheet to poured gypsum roof deck:
1. Special shaped nail providing diverging or hooking point.
2. Nail shall have flat cap not less than 30 mm (1-1/4 inch) across and shall have a withdrawal resistance of not less than 18 kg (40 pounds) per fastener.

H. Fasteners for securing insulation to steel decks:
1. Conform to requirements of Factory Mutual Research Corporation for wind uplift.
2. Self-drilling galvanized screws with 50 mm (two inch) diameter disk.
3. Antibackout thread design.
4. Have a pullout resistance of 14 kg (30 pounds) minimum.

2.5 RECOVERED MATERIALS

A. Comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Plastic rigid foams: Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material

Material Type	Percent by Weight
Glass fiber reinforced	6 percent recovered material
Rock wool material	75 percent recovered material

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

PART 3 - EXECUTION

3.1 GENERAL

A. Do not apply roof insulation if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon.

B. Entire roof deck construction of any section of the building shall be completed before insulation system work is begun. Curbs, blocking, edge strips, and other components which insulation, roofing and base flashing is attached to shall be in place ready to receive insulation and roofing. Coordinate roof insulation operations with roofing and sheet metal work so that insulation is installed to permit continuous roofing operations.

C. Insulation system materials shall be dry and damage free when applied. Do not use broken insulation or insulation with damaged facings. Remove damaged insulation from the site immediately.

D. Dry out surfaces , including the flutes of metal deck, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials only to dry substrates.

E. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, fog, snow, ice) or frost is present in any amount in or on the materials when temperature is below 10 °C (50 °F). Do not apply materials to substrate having temperature of 10 °C (50 °F) or less.

F. Phased construction is not permitted. The complete installation of all flashing, insulation, and roofing shall be completed in the same day except for the area where temporary protection is required when work is stopped.

G. Temporary Protection for Built-Up Roofing:
   1. Install temporary protection consisting of glaze coats and water cutoffs at the end of each day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.
   2. Glaze coat all exposed surfaces of insulation and felts to seal within the bitumen coating. No insulation or felt surfaces or edges shall be left exposed.
   3. Provide water cutoffs at exposed edges of insulation. Cutoffs shall consist of two plies of felt. The first ply extending 150 mm (six inches) beyond edge of roof insulation, the roof deck and the built-up roofing. The second ply covering the first ply and extending 75 mm (three inches) beyond the first. Install as specified for vapor retarder. When the work resumes, cut the protective felts along the vertical face of insulation and remove, exposing the edges of the insulation.
   4. Securely anchor insulation in place to prevent blow off and damage by construction activities.
   5. Provide for removal of water or drainage of water away from work.
   6. For roof areas that are to remain intact and that are subject to foot traffic and damage, provide wood walkways with notches in sleepers to permit free drainage.

H. Heating Bitumen:
   1. Heat the asphalt to the equiviscous temperature plus or minus 14 °C (25 °F), at the time of application.
      a. Asphalt shall not be heated more than 38 °C (100 °F) above the equiviscous temperature.
      b. When the equiviscous temperature is not furnished by the asphalt manufacturer, asphalt shall not be heated above 274 °C (525 °F) for Type III and IV and shall be not less than 246 °C (475 °F) at time of application.
   2. At no time shall bitumen be heated above the flash point temperature.
   3. Provide heating kettles with a thermometer kept in operating condition. Kettlemen shall be in attendance at all times during heating to insure that the bitumens are heated within the temperatures specified.

I. Use Type III or Type IV asphalt between plies of felt and for installing insulation and vapor retarders.

J. Application of Materials with Hot Bitumen:
   1. Apply bitumen in quantities required, immediately followed by materials to be embedded therein, before bitumen cools below the application temperature limit.
      a. Do not apply more material than can be covered at one time, except for glaze coats.
      b. Recoat cooled bitumen areas.

K. Primer: Use four liters (one gallon) of primer per 10 m^2 (100 square feet).

L. Quantities of Asphalt:
   1. Per square unless otherwise specified.
   2. Between insulation layers and deck or vapor retarder: 9 to 14 kg (20 to 30 pounds).
   3. Glaze coats: 7 to 11 kg (15 to 25 pounds).

M. Building Paper (Red rosin):
   1. Lay paper smoothly without buckles or wrinkles at right angles to the roof slope, starting at the low point.
   2. Lap each sheet of paper at least 50 mm (two inches) over preceding sheet, and at ends.
   3. Staple or nail sufficiently to hold in place until the vapor retarder and insulation is installed.

3.2 SURFACE PREPARATION

A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.

B. Remove projections that might damage materials.

C. Concrete Decks, Except Insulating Concrete:
   1. Test concrete decks for moisture prior to application of materials. Heat bitumen as specified and pour approximately 0.5 liters (one pint) of bitumen on surface to which roofing materials are to be applied. If bitumen foams upon contact with the deck or after bitumen has cooled and bitumen is stripped clean from deck leaving no residue, the deck is not dry enough for application of prime coat and subsequent work.
   2. Prime concrete decks, including precast unit, with primer and allow to dry before application of bitumen. Keep primer back 100 mm (four inches) from joints in precast unit.

D. Insulating Concrete:
   1. Allow to dry out for at least five days after installation before the placement of subsequent materials or insulation.
   2. If rain occurs during or at end of drying period or during installation, allow additional drying time before continuing the placement of the subsequent materials or insulation.

E. Poured gypsum shall be dried out in accordance with manufacturer's printed instructions prior to application of subsequent materials.

F. Cover wood sheathing, poured gypsum, gypsum plank, and cement wood fiber plank with a layer of building paper (red rosin).

3.3 VAPOR RETARDER

A. General:
   1. Install a continuous vapor retarder on roof decks as specified. Install a vapor retarder when phenolic insulation is used.
   2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
   3. At all pipes, walls, and similar penetrations through vapor retarder, seal openings with roof cement to prevent moisture entry from below.
   4. Mop felts solidly in place as specified.
   5. Seal penetrations with roof cement.

B. Cast in Place Concrete Decks, Except Insulating Concrete:
   1. Prime deck as specified.
   2. Apply two plies of asphalt saturated felt mopped down to deck.

C. Steel Deck:
   1. Material and method of application of roofing systems used on metal decks shall meet the requirements of Underwriters Laboratories for Class A or Factory Mutual Research Corporation for Class I Insulated Steel Roof Deck.
   2. Mechanically anchor a 25 mm (one inch) thick layer of mineral fiber board, cellular glass, or perlite board to meet the requirements of Factory Mutual Research Corporation for Class 1-60 Insulated Steel Deck Roofs.
   3. Locate the long dimension edge joints to have solid bearing on top of decking ribs; do not cantilever over rib openings or flutes.
   4. Apply two plies of asphalt saturated felt in hot bitumen to insulation board.

3.4 SELECTION OF RIGID INSULATION

A. Insulation Type:
   1. Use either cellular glass, mineral fiberboard, perlite board, phenolic board, isocyanurate board, or urethane board or a combination thereof.
   2. Use not less than two layers of insulation unless specified otherwise.
   3. Use either 25 mm (one inch) thick mineral fiberboard, cellular glass, or perlite board as first layer over steel decks. Do not use phenolic, isocyanurate, or urethane board type insulation directly on steel roof decks.
   4. Use either 13 mm (1/2 inch) thick perlite board or mineral fiber board as a top layer over urethane board or isocyanurate board. Composite board is acceptable.
   5. Use only cellular glass block for plaza or promenade decks.
   6. Where tapered insulation is used, all insulation shall be factory tapered, except perlite board may be field tapered.
   7. Use same insulation as existing for roof repair and alterations unless specified otherwise.

B. Insulation Thickness:
   1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the thermal resistance "R" value of not less than 13 for uniform thickness(average thickness where tapered insulation is used) .
   2. The minimum thickness of insulation for metal decks shall not be less than recommended by the insulation manufacturer to span the rib opening (flute size) of the metal deck used.

3. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Government.
4. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (drains) shall be not less than 38 mm (1-1/2 inches).
5. Use not less than two layers of insulation when insulation is 25 mm (one inch) or more in thickness unless specified otherwise.

3.5 INSTALLATION OF INSULATION

A. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer. Bed insulation layers in Type III or IV asphalt firmly pressed into the hot bitumen. Keep bitumen below surface of insulation to receive single ply rubber roofing.

B. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.

C. Cover all insulation installed on the same day by either:
   1. The roofing membrane as specified.
   2. Temporary protection as specified.

D. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.

E. Cut to fit tight against blocking or penetrations.

F. Over Vapor Retarder, or Concrete Deck: Lay insulation in hot bitumen as specified.

END OF SECTION

SECTION 07 27 16.01
SELF-ADHERING AIR BARRIER - VAPOR RESISTIVE

PART 1 - GENERAL

1.1 SUMMARY

A. Section provides for flexible rubberized asphalt, self-sealing air and vapor barrier and accessories.

B. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through wall assembly.

1.2 REFERENCES

A. American Society for Testing and Materials:
1. ASTM- E96: Test Methods for Water Vapor Transmission of Materials.
2. ASTM- E2178: Test Methods for Air Permeance of Building Materials.
3. ASTM- D570: Test Method for Water Absorption of Plastics.
4. ASTM- E154 : Test Method for Water Vapor Retarders used in contact with Earth Under Concrete Slabs, on Walls or as Ground Cover.
5. ASTM- D1004 : Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
6. ASTM- D1938 : Test Method for Tear Propagation Resistance of Plastic Film and Thin Sheeting by Single-Tear Method.
7. ASTM- D1876: Test Method for Peel Resistance of Adhesives.
8. ASTM- D1970 : Standard Specifications for Self-Adhering Polymer Modified Bituminous. Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
9. ASTM- D412: Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.
10. ASTM-E2357: Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
11. Field Test Standards:
12. ASTM-E783: Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
13. ASTM-E1105: Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
14. ASTM-E1186: Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

1.3 QUALITY ASSURANCE

A. Manufacturer: Air and vapor barrier systems shall be manufactured by firm with minimum of 20 years of experience in production of waterproofing.

B. Applicator: Experienced in application of air barrier materials similar in material, design complexity, and extent to those indicated for this Project, with a record of timely and successful in-service performance.

C. Material Performance Requirements: Air and vapor barrier membrane and auxiliary materials shall be tested to comply as follows:

1. Air Permeance: Not greater than 0.004 cfm/sf under pressure differential of 1.57 psi, as tested in accordance with ASTM-E2178.
2. Vapor Permeance: Not greater than 0.1 Perm when tested in accordance with ASTM-E96.

D. Assembly Performance: Continuous air and vapor barrier assembly shall provide the following property as demonstrated by laboratory testing:
1. Air Permeance: Not greater than 0.040 cfm/sf under pressure differential of 1.57 psi, as tested in accordance with ASTM-E2357.

E. Air barrier shall be joined in an airtight and flexible manner to air barrier material of adjacent systems, allowing for relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
1. Foundation and walls.
2. Walls and windows or doors.
3. Different wall systems.
4. Wall and roof.
5. Wall and roof over unconditioned space.
6. Walls, floors and roof across construction, control and expansion joints.
7. Walls, floors and roof to utility, pipe and duct penetrations.

1.4 PRE-INSTALLATION MEETING

A. Conduct pre-installation meeting prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Pre-installation meeting shall include Contractor, installer and system manufacturer's field representative. Agenda for meeting shall include but not be limited to following:
1. Review submittals.
2. Review surface preparation, minimum curing period and installation procedures.
3. Review special details and flashings.
4. Sequence of construction, responsibilities and schedule for subsequent operations.
5. Review mock-up requirements.
6. Review inspection, testing, protection and repair procedures.

1.5 SUBMITTALS

A. Shop Drawings:
1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

B. Product Data.

C. Project Information:
1. Written documentation demonstrating applicator's qualifications.
2. Minutes of Pre-installation meeting.

D. Contract Closeout Information:
1. Manufacturer's Warranty.
2. Applicator's Warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations for storage and handling of each product.

1.7 WARRANTY

A. Standard Product Warranty:

1. Submit manufacturer standard 1-year warranty that air and vapor barrier and accessories are free of defects at time of delivery, and are manufactured to meet manufacturer's published physical properties and material specifications.
2. Installer to warrant that air and vapor barrier and accessories have been installed in accord with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers:
   1. Self-adhering Air and Vapor Barrier System:
      a. Base:
         1) Grace Construction Products.
      b. Optional:
         1) Henry.
         2) Carlisle Coatings and Waterproofing, Incorporated.
         3) Tremco.
   2. Or approved equal.

2.2 GENERAL

A. Provide primary materials of one manufacturer for each component required for work or as noted.

B. Base Product: Grace Construction Products, Perm-A-Barrier Wall Membrane.

C. Self-adhesive 40 mil, rubberized asphalt integrally bonded to cross-laminated, high-density polyethylene film.

D. Air and Vapor Barrier Accessories:
   1. Surface Conditioner: Water-based latex liquid. . Perm-A-Barrier WB Primer.
   2. Termination Mastic: Rubberized asphalt based mastic. . Bituthene Mastic.
   3. Primer: Water-based latex primer. Perm-A-Barrier WB Primer. Or approved as equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with installer present, for compliance with requirements for installation, tolerances and other specific conditions affecting performance of air and vapor barrier.

3.2 SUBSTRATE PREPARATION

A. Substrate to be smooth and free of voids, spalled areas, loose aggregate and sharp protrusions that would hinder adhesion or regularity of air and vapor barrier membrane.

B. Remove deleterious materials from surfaces to be covered.

3.3 INSTALLATION

A. Refer to manufacturer's literature for directions for installation.

B. Perform work only when existing and forecast weather conditions are within limits established by manufacturer.

C. Air and Vapor Barrier Membrane:

1. Surface Conditioner : Apply by spray, brush, or roller at rate recommended by manufacturer. Allow to dry completely before membrane application.
2. Primer: Apply at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application.
3. Apply membrane horizontally or vertically to primed substrates and press firmly into place with hand roller.
4. Apply membranes horizontally to primed CMU along the underside line of masonry anchors, beginning at base of wall. Overlap sheet below 2 IN minimum.
5. Backnail membrane along side lap prior to installing next sheet of membrane at soffits, ceilings or oriented strand board (OSB).
6. Mastic: Apply bead or trowel coat along membrane edges, seams, cuts, and penetrations.

3.4 FIELD QUALITY CONTROL

3.5 PROTECTION

A. Protect from damage by other trades and construction materials.

SECTION 07 42 43.01
ALUMINUM COMPOSITE MATERIAL (ACM) SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Composite wall panel system consisting of aluminum-faced composite panels in a rainscreen application with associated metal trim, and secondary framing.

1.2 RELATED REQUIREMENTS

A. Division 07 air barrier section for transition and flashing components of building air/moisture barrier.

B. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal copings, flashings, reglets and roof drainage items.

C. Division 07 Section "Joint Sealants" for field-applied joint sealants.

1.3 SYSTEM DESCRIPTION

A. Composite Metal Panel Wall System: Pressure-equalized rainscreen design consisting of dry seal horizontal joinery designed to minimize water penetration and induce air circulation in the compartmentalized space behind the panel system. Preformed return side joints form a vertical compartmentalized space behind each column of panels to channel moisture from top to bottom of wall keeping primary air and moisture barrier dry. Moisture weeping trim at low points allows water to drain out of the system.

1.4 REFERENCE STANDARDS

A. American Architectural Manufacturer's Association (AAMA):
   1. AAMA 508 Voluntary Test Method and Specifications for Pressure Equalized Rain Screen Wall Cladding Systems.
   2. AAMA 620 - Voluntary Specification High Performance Organic Coatings on Coil Coated Architectural Aluminum.
   3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM):

1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM B 209 - Specification for Aluminum and Aluminum Alloy Sheet and Plate.
3. ASTM C 645 - Specification for Nonstructural Steel Framing Members.
4. ASTM D 3359 - Standard Test Methods for Measuring Adhesion by Tape Tests.
5. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.
6. ASTM E 329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

D. National Fire Protection Association (NFPA):
   1. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide composite wall panel system meeting performance requirements as determined by application of specified tests by a qualified testing agency on manufacturer's standard assemblies.

B. Structural Performance: Design composite wall panel system fabricated to withstand effects of indicated loads and stresses within limits and under conditions indicated below.
   1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
   2. Limits of Deflection: Composite wall panel system shall withstand scheduled wind pressure with the following allowable deflection:
   3. a. Maximum allowable deflection limited to L/175 deflection of panel perimeter normal to plane of wall.
   4. b. Maximum allowable deflection of panel stiffeners and aluminum panel material combined limited to L/60.
   5. 3. Seismic Performance: Comply with ASCE 7 Section 9, "Earthquake Loads."

C. Pressure Equalized Rain Screen Performance: Water Penetration: Pass AAMA 508 with a 15 psf pressure difference with an imperfect air and water barrier, in accordance with the following:
   1. Test rain screen performance utilizing ventilation areas of minimum 7 square inch per 10 feet (4500 mm per 3 m) of horizontal joint, with a cavity volume to vent area ratio of between 10 and 50, with sealed vertical joints in the rainscreen panel.
   2. Install test air/moisture barrier meeting air infiltration performance of 0.04 cfm per square foot at a pressure differential of 1.57 psf when tested per ASTM E 283. Locate test air/moisture barrier maximum of 3 inches (76 mm) behind rainscreen.

D. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum 10 years experience in manufacture of similar products in successful use in similar applications.
   1. 1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
      a. Product data, including certified independent test data indicating compliance with requirements.
      b. Samples of each component.
      c. Sample submittal from similar project.

d. Project references: Minimum of 5 installations not less than 5 years old, with Owner and Architect contact information.
e. Sample warranty.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
3. Approved manufacturers must meet separate requirements of Submittals Article.

B. Wall Systems Installer Qualifications: Experienced Installer with minimum of 5 years experience with successfully completed projects of a similar nature and scope.

C. Adhesion Test: Prior to delivery of composite wall panel system, perform test on adhesives and sealants per ASTM D 3359. Test each adhesive and sealant utilizing specified panel finish.
1. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as specified in Division 07 Section "Joint Sealants."

D. Fire Performance Characteristics: Provide metal composite wall systems with the following fire-test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
1. Surface-Burning Characteristics: Provide metal composite wall system panels with the following characteristics when tested per ASTM E 84.
a. Flame spread index: 25 or less.
b. Smoke developed index: 450 or less.
2. Intermediate Scale Multistory Fire Test: Representative mockup tested per NFPA 285.

1.7 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's technical representative, and other trade contractors.
1. Coordinate building framing in relation to composite wall panel system.
2. Coordinate installation of building air and water barrier behind composite wall panel system.
3. Coordinate window, door and louver, and other openings and penetrations of composite wall panel system.

1.8 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products.

B. Shop Drawings: Provide shop drawings prepared by manufacturer or manufacturer's authorized dealer. Include full elevations showing openings and penetrations. Include details of each condition of installation and attachment. Provide details at a minimum scale 1-1/2-inch per foot of all required trim and extrusions needed for a complete installation.
1. Include data indicating compliance with performance requirements.
2. Indicate points of supporting structure that must coordinate with composite wall panel system installation.

D. Samples for Initial Selection: For each product specified including sealants and gaskets. Provide representative color charts of manufacturer's full range of colors.

E. Samples for Verification: Provide 24-inch (600 mm) section of wall panel showing finishes, horizontal joinery, vertical joint return, injected core material, panel stiffener and anchoring details. Provide 12-inch (300 mm) long pieces of each extruded aluminum trim and gaskets.

1.9 **INFORMATIONAL SUBMITTALS**

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

B. Buy American Act Certification: Submit documentation certifying that products comply with provisions of the Buy American Act 41 U.S.C 10a – 10d.

C. Qualification Information: For Installer, Installer's field supervisor and professional engineer.

D. Manufacturer's warranty: Submit sample warranty.

1.10 **CLOSEOUT SUBMITTALS**

A. Maintenance data.

1.11 **DELIVERY, STORAGE, AND HANDLING**

A. Protect products of composite wall panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage.
   1. Deliver, unload, store, and erect composite wall panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.

1.12 **WARRANTY**

A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal wall panel assemblies that fail in materials and workmanship within two years from date of Substantial Completion.

B. Special Panel Finish Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace wall panels that evidence deterioration of finish within 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 **MANUFACTURERS**

A. Basis of Design: **CENTRIA, FormaBond Composite Wall Panel System**. Provide basis of design product, or comparable product approved by Architect prior to bid.
   1. 1. CENTRIA Architectural Systems; Moon Township, PA 15108-2944. Tel: (800)759-7474. Tel: (412)299-8000. Fax: (412)299-8317. Email: info@CENTRIA.com. Web: www.CENTRIA.com.

B. Or Approved Equal

2.2 **MATERIALS**

A. Aluminum Sheet: Smooth surface coil-coated sheet, ASTM B209, 5052 H32 Aluminum alloy.

B. Aluminum Extrusions: ASTM B 221, 6063 T5 Aluminum.

C. Panel Core: Thermo-set polymeric core, fire-retardant per ASTM E 84, with flame-spread index of 25 or less and smoke-developed index of 450 or less.

2.3 COMPOSITE METAL PANELS

A. Composite Metal Panels: Factory-formed, aluminum-faced composite panels fabricated from two sheets of 0.032 inch (0.813 mm) thick aluminum facing sheets with metal facings bonded to reaction injected polymeric core, with integral reveals and rout and return joinery.
   1. Thickness: 8 mm. nominal.
   2. Panel Flatness: Maximum allowable distortion: 1/32 inch in 24 inches (0.794 mm in 600 mm) in any direction.
   3. Horizontal Joints: Pressure-equalized.
   4. Vertical Joints: Pre-formed returns with gasket and aluminum extrusion receptors and seal plates.
   5. Stiffeners: Manufacturer's standard stiffener as required to meet performance requirements.

B. Face Sheet Surface: Honeycomb.

C. Face Sheet Coil-Coated Finish:
   1. Fluoropolymer Two-Coat System: 0.2-mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat, AAMA 620.
      a. Basis of Design: CENTRIA Fluorofinish.
   2. Fluoropolymer Two-Coat Mica System: 0.2-mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat providing a pearlescent appearance, AAMA 620.
      a. Basis of Design: **CENTRIA Sundance Mica**.
   3. Fluoropolymer Three-Coat Metallic System: 0.2 mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat containing metal flakes, and a 0.5-mil 70 percent PVDF fluoropolymer clear coat, AAMA 620.
      a. Basis of Design: **CENTRIA Sundance AM**.
   4. Color: Match Architect's custom color.

D. Unexposed Finish: Manufacturer's standard primer.

E. Exposed Trim and Fastener Finish: Match panel finish.

2.4 SECONDARY METAL FRAMING

A. Miscellaneous Framing Components, General: Cold-formed metallic-coated steel sheet, ASTM C 645, Grade 50, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating.
   1. Hat Channels: 0.053 inch/16 ga. (1.34 mm) minimum.
   2. Sill Channels: 0.053 inch/16 ga. (1.34 mm) minimum.

2.5 **2.5 ACCESSORIES**

A. Provide manufacturer's factory-formed clips, shims, flashings, sealants, and tapes for a complete installation.

B. Extruded Trim: Aluminum, minimum thickness 1/16 inch (1.59 mm) for trim and 3/32 (2.38 mm) for structural units. Include manufacturer-provided extruded trim for the following locations and as indicated on Drawings:
   1. Base trim.
   2. Coping.
   3. Panel installation perimeter.
   4. Opening perimeters.

C. Gaskets: Panel manufacturer's EPDM or neoprene, fire-retardant-treated.

D. Sealants: Type recommended by composite wall panel system manufacturer for application, meeting requirements of Division 07 Section "Joint Sealants."

E. Flashing Tape: 4 inch (102 mm) wide self-adhering butyl flashing tape.

2.6 FABRICATION

A. General: Fabricate composite wall panels and accessories at factory identical to tested units using manufacturer's standard procedures and processes necessary to meet performance requirements.
   1. Fabricate composite wall panels with dry seal, pressure equalizing horizontal joinery, channel enclosing side lap returns, extruded aluminum stiffeners and reaction injected molded polymeric core that require no further fabrication or modification in field.
   2. Provide components of composite wall panel system that are products of one manufacturer, including composite panels, gaskets, head and sill trim, bottom weep, base extrusion, and metal copings.

PART 3 - PART 3 - EXECUTION

3.1 INSPECTION

A. Examine composite wall panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of composite wall panel system.
   1. Inspect framing that will support composite wall panel system to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to composite wall panel system manufacturer.
      a. Maximum deviations acceptable to composite wall panel system manufacturer:
         1) 1/4-inch in 20 feet (6.4 mm in 6 m) vertically or horizontally from face plane of framing.
         2) 1/2-inch (12.7 mm) maximum deviation from framing face plane on any building elevation.
         3) 1/8-inch in 5 feet (3.2 mm in 1.5 m).
   2. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of composite wall panel system.
   3. Verify that window, door, louver and other penetrations match layout on shop drawings.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with composite wall panel system installation.

3.2 COMPOSITE WALL PANEL SYSTEM INSTALLATION

A. General: Install composite wall panel system in accordance with approved shop drawings and manufacturer's recommendations.

B. Installation: Attach panels to metal framing using recommended clips, screws, fasteners, sealants, and adhesives indicated on approved shop drawings.
   1. Horizontal Joinery: Working from base of installation to top connect upper panel to lower panel at dry seal joinery.
   2. Vertical Joinery: Provide reveal between vertical ends of panels as shown on shop drawings using hardware and gaskets furnished by manufacturer to form a weather tight seal between panels.
   3. Galvanic Action: Where elements of metal composite wall system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

C. Rainscreen Installation: Proceed with installation of manufacturer's dry seal, pressure equalizing horizontal joinery. Keep open spaces in horizontal joinery intended to ventilate cavity behind system. Maintain clear air column from top to bottom of wall.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a service representative authorized by metal wall panel manufacturer to inspect completed installation. Submit written report. Correct deficiencies noted in report.

3.4 CLEANING AND PROTECTION

A. Remove temporary protective films. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt, and sealant. Maintain in a clean condition during construction.

B. Replace damaged panels and accessories that cannot be repaired by field repair.

END OF SECTION

SECTION 07 51 00
BUILT-UP BITUMINOUS ROOFING, COLD APPLIED

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes cold-applied bituminous[hybrid] built-up roofing with smooth surface with applied solar reflective coating.

1.2 RELATED WORK

A. Roof Insulation: Section 07 22 00, ROOF AND DECK INSULATION.

B. Vapor barrier: Section 07 22 00, ROOF AND DECK INSULATION.

C. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 60 00, FLASHING AND SHEET METAL.

D. Miscellaneous items: Section 07 71 00, ROOF SPECIALTIES.

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. Asphalt Roofing Manufacturers Association/National Roofing Contractors Association (ARMA/NRCA): Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing

E. ASTM International (ASTM):

C1370-00(R2005)	Standard Test Method for Determining the Chemical Resistance of Aggregates for Use in Chemical-Resistant Sulfur Polymer Cement Concrete and Other Chemical-Resistant Polymer Concretes
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
D146-04	Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
D1644-01(R2006)	Standard Test Methods for Nonvolatile Content of Varnishes
D1863-05	Mineral Aggregate Used on Built-Up Roofs
D2178-04	Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
D2523-00(R2006)	Standard Practice for Testing Load-Strain Properties of Roofing Membranes

D2823-05	Standard Specification for Asphalt Roof Coatings, Asbestos Containing
D3909-97(2004)	Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules
D3960-05	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
D4073-06	Standard Test Method for Tensile-Tear Strength of Bituminuous Roofing Membranes
D4263-83(R2005)	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
D4586-07	Asphalt Roof Cement, Asbestos Free
D4601-04	Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
D4897-01	Asphalt Coated Glass Fiber Venting Base Sheet Used in Roofing
D5147-07	Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material
D5201-05(R2010)	Standard Practice for Calculating Formulation Physical Constants of Paints and Coatings
D6162-00(R2008)	Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
D6163-00(R2008)	Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
D6164-05	Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
D6511-06	Standard Test Methods for Solvent Bearing Bituminous Compounds
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
WK29032-10	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer

F. 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.

G. Cool Roof Rating Council:

CRRC-1	Product Rating Program, www.coolroofs.org

H. 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.
1-49-09	Loss Prevention Data Sheet: Perimeter Flashing

I. National Roofing Contractors Association: Roofing and Waterproofing Manual

J. U.S. Environmental Protection Agency (EPA):

EPA 600/R13/116-02	Method for the Determination of Asbestos in Bulk Building Materials

K. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog, www.biopreferred.gov

L. 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 Membrane System Load-Strain Properties: Provide a roofing membrane identical to component systems that have been successfully tested by a qualified independent testing and inspecting agency to meet the following minimum load-strain properties at membrane failure when tested according to ASTM D2523:
   1. Tensile strain at failure, at 0 deg F (-18 deg C): 600 lbf(2.67 kN) cross machine direction, minimum; 4.0 to 5.5 percent elongation at break.

C. 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. 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.
   2. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980 based on testing identical products by a qualified testing agency.
   3. Energy Performance, CRRC-1: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.
   4. 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 emittance 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. Provide manufacturer's certification that field applied bituminous coatings and mastics, and field applied roof coatings comply with limits for Volatile Organic Compounds (VOC) per the National Volatile Organic Compound Emission Standards for Architectural Coatings pursuant to Section 183(e) of the Clean Air Act with limits as follows:
      a. Bituminous Coatings and Mastics: 500 g/l (4.2 lb/gal.).
      b. Roof Coatings: 250 g/l (2.1 lb/gal.).
   3. 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.

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. Roofing System Design: Provide roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
   5. 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-60 .
      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 Resident Engineer.
   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. Asphalt and adhesive materials.
   2. Base and ply sheet roofing and flashing membrane.
   3. Roofing cement.

4. Fastening requirements.
5. Roof walkway.
6. Aggregate surfacing and surfacing adhesive.
7. Coating.
8. Application instructions.

C. Samples:
1. Nails and fasteners, each type.

D. Shop Drawings: Include plans, sections, details, and attachments.
1. Base flashings and terminations.
2. Nailers and cants.

E. Certificates:
1. Indicating materials and method of application of roofing system meets requirements of FM Approvals "RoofNav" for specified fire/windstorm classification.
2. Indicating compliance with Miami-Dade County requirements.
3. Indicating compliance with load/strain properties requirement.
4. Indicating compliance with energy performance requirement.

F. Warranty: As specified.

G. Documentation of supervisors' and inspectors' qualifications.

H. Field reports of roofing inspector.

I. Temporary protection plan. Include list of proposed temporary materials.

J. Contract Close-out Submittals:
1. Maintenance Manuals.
2. Warranty signed by installer and manufacturer.

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.

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

A. Roofing system is subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period is extended to [10] years.

PART 2 - PRODUCTS

2.1 ADHESIVE AND ASPHALT 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.
   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. Multipurpose Construction Adhesives: 70 g/L.
      b. Contact Adhesives: 80 g/L.
      c. Other Adhesives: 250 g/L.
      d. Nonmembrane Roof Sealants: 300 g/L.
      e. Sealant Primers for Nonporous Substrates: 250 g/L.
      f. Sealant Primers for Porous Substrates: 775 g/L.

B. Water-Based Asphalt Primer: Water-based, polymer modified, asphalt primer with the following physical properties:
   1. Asbestos Content, EPA 600/R13/116: None.
   2. Non-Volatile Content, minimum, ASTM D2823: 30 percent.
   3. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 65 g/L.

C. Cold-Applied Adhesive for sheet membrane: One-part, asbestos-free, low-volatile, cold-applied adhesive specially formulated for compatibility and use with specified roofing membranes and flashings, with the following physical properties:
   1. Asbestos Content, EPA 600/R13/116: None.
   2. Volatile Organic Compounds (VOC), maximum, ASTM D6511: <250 g/L.
   3. Nonvolatile Content, minimum, ASTM D6511: 75 percent.
   4. Uniformity and Consistency, ASTM D6511: Pass.

D. Cold-Applied Adhesive for membrane flashing: One-part, cold-applied adhesive specially formulated for compatibility and use with specified roofing membranes and flashings, with the following physical properties:
   1. Asbestos Content, EPA 600 R13/116: None.
   2. Volatile Organic Compounds (VOC), maximum, ASTM D6511: <250 g/L.
   3. Nonvolatile Content, minimum, ASTM D6511: 75 percent.
   4. Uniformity and Consistency, ASTM D6511: Pass.

E. Roof Cement: ASTM D4586, Type II.

2.2 MEMBRANE AND SHEET MATERIALS:

A. Membrane Materials, General: Provide combination of base, ply, and cap sheet materials that have been tested in combination and comply with load/strain properties performance requirement in Part 1 of this Section.

B. Base Sheet: ASTM D4897, Type II, venting, nonperforated, heavyweight, asphalt-impregnated and coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.

C. Base Sheet: ASTM D4601, Type II, nonperforated, asphalt-impregnated and coated glass-fiber sheet dusted with fine mineral surfacing on both sides, with the following properties:
   1. Breaking Strength, minimum, ASTM D146: cross machine direction, 12.2 kN/m (70 lbf/in).

2. Pliability, 12.7 mm (1/2 inch) radius bend, ASTM D146: No failures.

D. Base Sheet: ASTM D4601, Type II or III, nonperforated, asphalt-coated, composite polyester/fiberglass/polyester reinforced sheet dusted with fine mineral surfacing on both sides, with the following properties:
   1. Breaking Strength, minimum, ASTM D146: cross machine direction, 21.0 kN/m (120 lbf/in).
   2. Tear Strength, minimum, ASTM D4073: cross machine direction, 880 N (200 lbf).
   3. Pliability, 12.7 mm (1/2 inch) radius bend, ASTM D146: No failures.

E. Ply Sheet: ASTM D 4601, Type II, nonperforated, asphalt-impregnated and coated glass-fiber sheet dusted with fine mineral surfacing on both sides, with the following properties:
   1. Breaking Strength, minimum, ASTM D 146: machine direction, 90 lbf/in; cross machine direction, 70 lbf/in.

F. Cap Sheet: Same as ply sheet.

G. Cap Sheet: ASTM D3909, asphalt-impregnated and -coated, glass-fiber cap sheet, with white coarse mineral-granule top surfacing and fine mineral surfacing on bottom surface.

H. Cap Sheet: ASTM D6163, Grade G, Type II, glass-fiber-reinforced, SBS/SEBS/SIS modified asphalt sheet; granular surfaced; and as follows:
   1. Exterior Fire-Test Exposure, ASTM E108: Class A.
   2. Tensile Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 24 kN/m (140 lbf/in).
   3. Tear Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 880 N (200 lbf).
   4. Elongation at 23 deg. C (73 deg. F), minimum, cross machine direction, at 5 percent maximum load ASTM D5147: 40 percent.
   5. Low Temperature Flex, maximum, ASTM D5147: -31 deg. C (-25 deg. F).

I. Cap Sheet: ASTM D6163, Grade G, Type II, glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced with a factory applied, white, reflective, acrylic coating; CRRC listed and California Title 24 Energy Code compliant; and as follows:
   1. Exterior Fire-Test Exposure, ASTM E108: Class A.
   2. Tensile Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 12.2 kN/m (70 lbf/in).
   3. Tear Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 440 N (100 lbf).
   4. Elongation at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 7.5 percent.
   5. Low Temperature Flex, maximum, ASTM D5147, -26 deg. C (-15 deg. F).
   6. Reflectance, ASTM C1549: 71 percent.
   7. Thermal Emittance, ASTM C1371: 0.87.
   8. Solar Reflectance Index (SRI), ASTM E1980: 87.

J. Cap Sheet: ASTM D6162, Grade G, Type III, composite polyester and glass-fiber-reinforced, SBS/SEBS-modified asphalt sheet; granular surfaced with a factory applied, white, reflective, acrylic coating; CRRC listed and California Title 24 Energy Code compliant; and as follows:
   1. Exterior Fire-Test Exposure, ASTM E108: Class A.
   2. Tensile Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 84 kN/m (480 lbf/in).
   3. Tear Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 330 N (750 lbf).
   4. Elongation at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 6 percent.

5. Low Temperature Flex, maximum, ASTM D5147, -26 deg. C (-15 deg. F).
6. Reflectance, ASTM C1549: 75 percent.
7. Thermal Emittance, ASTM C1371: 0.86.
8. Solar Reflectance Index (SRI), ASTM E1980: 92.

K. Base Flashing Backer Sheet: ASTM D4601, Type II, asphalt-impregnated and coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

L. Base Flashing Backer Sheet: Same as ply sheet.

M. Base Flashing Sheet: ASTM D6164, Grade G, Type II, polyester-reinforced, SBS-modified asphalt sheet; granular surfaced; Granule Color: White.

2.3 FASTENERS

A. Roofing Fasteners: Factory-coated steel fasteners and metal or plastic plates, where applicable, meeting requirements of FM Approvals 4470, tested by fastener manufacturer for required pullout strength, and recommended by roofing manufacturer for application.

B. Accessory Fasteners: Corrosion-resistant fasteners compatible with adjacent materials and recommended for application by manufacturer of component to be fastened.

2.4 COATINGS

A. White Roof Coating: Water-based, Energy Star Certified, CRRC listed and California Title 24 Energy Code compliant elastomeric roof coating formulated for use on bituminous roof surfaces, with the following physical properties:
1. Asbestos Content, EPA/600/R13/116: None.
2. Non-Volatile Content (by weight), minimum, ASTM D1644: 60 percent.
3. Volatile Organic Compounds (VOC), ASTM D3960: 35g/L.
4. Percent Solids (by volume), minimum, ASTM D5201: 60 percent.
5. Reflectance, minimum, ASTM C1549: 86 percent.
6. Emissivity, minimum, ASTM C1370: 0.93.
7. Solar Reflectance Index (SRI), ASTM E1980: 103.

B. White Roof Coating: Intumescent, fire-retardant, Energy Star Certified, CRRC listed and California Title 24 Energy Code compliant, elastomeric, acrylic latex roof coating formulated for use on bituminous roof surfaces, with the following physical properties:
1. Asbestos Content, EPA/600/R13/116: None.
2. Non-Volatile Content (by weight), minimum, ASTM D1644: 67 percent.
3. Reflectance, minimum, ASTM WK29032: 82 percent.
4. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 155 g/L.
5. Solar Reflectance Index (SRI), ASTM E1980: 103.

2.5 SURFACING AND COATINGS

A. Aggregate Surfacing, Stone: ASTM D1863, except the use of crushed stone is prohibited.

B. Aggregate Surfacing, Slag or Gravel: Use slag on slopes over 1:10 (one inch per foot).

C. Aggregate Surfacing, Solar Reflective: White marble aggregate, Solar Reflectance Index (SRI) when applied with specially formulated white adhesive, Hardness 3.5 Mohs.

D. Aggregate Surfacing Adhesive: Cold-applied surfacing adhesive, with VOC content less than 250 g/L, formulated for fire-resistant properties.

E. Aggregate Surfacing Adhesive, Solar Reflective: One-part, white, highly reflective polymeric surfacing adhesive, CRRC listed and California Title 24 Energy Code compliant when combined with approved white gravel, with following physical properties:

1. Asbestos Content, EPA 600 R-93/116: None.
2. Volatile Organic Compounds (VOC), maximum, ASTM D 6511: 250 g/L.
3. Nonvolatile Matter, minimum ASTM D 6511: 50 percent.
4. Reflectance (adhesive plus aggregate), ASTM C 1549: 71 percent.
5. Thermal emittance (adhesive plus aggregate), ASTM C 1371: 0.85.
6. Solar Reflectance Index (SRI), adhesive plus gravel, ASTM E 1980: 86.

F. White Roof Coating: Water-based, Energy Star Certified, CRRC listed and California Title 24 Energy Code compliant elastomeric roof coating formulated for use on bituminous roof surfaces, with the following physical properties:
1. Asbestos Content, EPA/600/R13/116: None.
2. Non-Volatile Content (by weight), minimum, ASTM D 1644: 60 percent.
3. Volatile Organic Compounds (VOC), ASTM D 3960: 35g/L.
4. Percent Solids (by volume), minimum, ASTM D 5201: 60 percent.
5. Reflectance, minimum, ASTM C 1549: 86 percent.
6. Emissivity, minimum, ASTM C 1370: 0.93.
7. Solar Reflectance Index (SRI), ASTM E 1980: 103.

G. White Roof Coating: Intumescent, fire-retardant, Energy Star Certified, CRRC listed and California Title 24 Energy Code compliant, elastomeric, acrylic latex roof coating formulated for use on bituminous roof surfaces, with the following physical properties:
1. Asbestos Content, EPA/600/R13/116: None.
2. Non-Volatile Content (by weight), minimum, ASTM D 1644: 67 percent.
3. Reflectance, minimum, ASTM WK 29032: 82 percent.
4. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 155 g/L.
5. Solar Reflectance Index (SRI), ASTM E 1980: 103.

2.6 ROOF WALKWAY

A. Prefabricated asphalt plank consisting of a homogeneous core of asphalt, plasticizers and inert fillers, bonded by heat and pressure between two saturated and coated sheets of felt:
1. Top side of plank surfaced with ceramic granules. Granule Color: White.
2. Size: Minimum 13 mm (1/2-inch) thick, manufacturer's standard size, but not less than 300 mm (12 inches) in least dimension and 600 mm (24 inches) in length.

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 bitumen.

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.
   1. Glaze coat exposed surfaces of felts to seal within the bitumen coating. Do not leave felt surfaces or edges exposed.

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 Resident Engineer, 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 FM 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, including ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing"

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 BUILT-UP BITUMINOUS ROOFING

A. Primer: Apply primer to substrates where recommended by roofing manufacturer, in application quantities recommended by roofing manufacturer.

B. Cold-Applied Adhesive:
   1. Apply cold-applied adhesive in a uniform application at rate recommended by manufacturer.

C. Built-Up Membrane Sheets:
   1. Number of Plies: [4], minimum, including cap sheet, and not including base sheet if any. Provide additional plies as required to meet load/strain properties specified in Part 1 of this Section.
   2. Commence the laying of sheets at the low points.
   3. Roll sheets into cold-applied adhesive brushing down to firmly embed, free of wrinkles, fish mouths, blisters, bubbles, voids, air pockets or other defects that prevent complete adhesion:
   4. Cut to fit closely around pipes, roof drains, bitumen stops, and similar roof projections.
   5. Lap sheets shingle fashion starting with starter strips at right angles to slope of roof.
   6. Laps for base sheet and ply sheets:
      a. Base sheet, lapped 50 mm (2-inches).
      b. Two plies with 450 mm (18-inches) and 900 mm (36-inch) starting widths, lapped 480 mm (19-inches).
      c. Three plies with 300 mm (12-inches) 600 mm (24-inches) and 900 mm (36-inch) starting widths, lapped 624 mm (24-1/2 inches).
      d. Four plies with 230, 460, 690 and 900 mm (9, 18, 27 and 36-inch) starting widths, lapped 700 mm (27-1/2 inches).
      e. End joints of ply and base sheet, lapped 50 mm (2-inches). Stagger end joints in relation to joints in adjacent and proceeding plies.

D. Roofing on Nailable Decks:
   1. On insulating concrete, install one ply of venting base sheet with mineral aggregate surface down, nailed to deck with lap as specified and seal lap edges with roof cement. Terminate venting base sheet as follows:
      a. At vertical surfaces: Extend venting base sheet up vertical surface over cants to top of base flashing or curb.
      b. At roof edge under gravel stops install venting base sheet over blocking: Extend base sheet not less than two inches beyond outer edge and turn down so that venting can be accomplished.
      c. At roof edge over fascia-cant: Extend base sheet over top of cant and turn down over outer face of cant to permit venting at the edge.
   2. On poured gypsum, precast gypsum plank, cement-wood fiber plank, wood plank, or plywood decks install one layer of building paper followed by base sheet.
      a. Apply building paper lapping ends and edges 50 mm (two inches) Lay smoothly without buckles or wrinkles. Staple or nail sufficiently to hold in place until roof membrane is installed.
      b. One ply of venting base sheet. Lay base sheet down dry on deck, Nail as specified. Lap as specified and seal lap edges with roof cement.

E. Roof edges and terminations:

1. Where nailers occur at roof edges under gravel stops or penetrations to receive metal base flashing, apply a continuous strip of underlayment over the nailers before the first ply sheet is applied. Strip shall be installed on top of venting base sheet if any.
2. After membrane is installed, turn the underlayment back over the roofing, and secure in place with cold-applied adhesive before gravel stops or other metal flanges extending out onto the membrane are installed.
3. Where cants occur at vertical surfaces, cut off roofing sheets two inches above top of cant strips, except at prefabricated curbs, scuttles and other roof accessories having integral cants, extend membrane over cant and up vertical surface to top of curb or nailer as shown.
4. Where fascia-cant occurs at roof edges, extend membrane beyond outside cant face and cut off at outside after base flashing is installed.
5. Where reglet occurs at vertical surfaces, extend plies roofing sheets up into reglet the full depth of the reglet.

F. Base Sheet Installation:
1. One ply of base sheet dry to deck, except mop between laps. Lap and attach as specified to deck.

G. Venting Base Sheet Installation:
1. At vertical surfaces: Extend venting base sheet up vertical surface over cants to top of base flashing or curb.
2. At roof edge under gravel stops install venting base sheet over blocking: Extend base sheet not less than 50 mm (2-inches) beyond outer edge and turn down to allow venting at the edge.
3. At roof edge over fascia-cant: Extend base sheet over top of cant and turn down over outer face of cant to allow venting at the edge.

H. Roof Ply Installation:
1. Extend first ply sheet 100 mm (4-inches) beyond the insulation and the second ply sheet 75 mm (3-inches) beyond the first. Lap ends 75 mm (3-inches) with joints broken 450 mm (18-inches) in each ply.

I. Cap Sheet Installation:
1. Install cap sheet in a solid application of cold-applied adhesive.
2. Extend cap sheet 100 mm (4-inches) beyond the underlying ply 75 mm (3-inches). Lap ends 75 mm (3-inches) with joints broken 450 mm (18-inches) in each ply.

3.6 BASE FLASHING

A. Prime vertical surfaces of masonry and concrete with asphalt primer except where vented base sheet is required to provide edge venting.

B. Apply flashing on top of built-up roofing, up face of cant and vertical surfaces, at least 200 mm (8-inches) above the roof, full height beneath counter flashing or top of curb flashing:
1. At fascia-cants, extend to top of cant and cut off.
2. Extend plies of roofing into reglet the full depth of the reglet.

C. Except at metal fascia cants, secure top edge of base flashing with nails on a line approximately one inch below top edge, spaced not more than 200 mm (8-inches) on center.
1. Cover all nail heads with roof cement.
2. Cover the top of the base flashing with counter flashing as specified in Section 07 60 00, FLASHING AND SHEET METAL. At the cants secure the top edge of the flashing with fascia compression clamp as specified in Section 07 60 00, FLASHING AND SHEET METAL.

D. Install flashing using longest pieces practicable. Complete splices between flashing and main roof sheet before bonding to vertical surface. Seal splice not less than 76mm (3-inches) beyond fasteners that attach membrane to blocking. Apply bonding adhesive to both flashing and surface to which flashing is being adhered per manufacturer recommendations. Nail top of flashing 300mm (12-inches) on center under metal counter flashing or cap.
   1. Parapet Walls: Extend up parapet and turn over top edge. Apply with 100 percent adhesive.

E. Install flashing over cants to make system watertight.

F. Install flashing before final roofing coat and aggregate are installed.

3.7 STRIPPING

A. Set flanges of metal flashing in roof cement before the final bituminous coat and roof aggregate are installed and nail to blocking per Section 07 60 00, FLASHING AND SHEET METAL.

B. Before the final bituminous coat and aggregate are installed, cover that portion of the horizontal flanges of metal base flashing, gravel stops and other flanges, extending onto the roofing with flashing sheet.

3.8 AGGREGATE SURFACING

A. After bituminous base flashing and stripping has been installed, uniformly coat the entire roof surface, except cants, with bitumen pour coat at the rate scheduled.

B. Embed aggregate to cover the roofing sheet completely without bare spots, but not less than 20 Kg/m² (400 pounds/) of dry gravel or 15 Kg/m² (300 pounds/100 square feet) of dry slag per. Do not leave any exposed bitumen.

C. Do not embed aggregate under roof walkways.

D. In cold weather preheat aggregate prior to application.

E. Do not place aggregate material in piles or rows on bare or glaze coated felt.

F. If aggregate surfacing is delayed, promptly apply glaze coat of cold-applied adhesive at rate scheduled.

3.9 ROOF WALKWAYS

A. Install roof walkways where shown.

B. Set prefabricated planks in solid application of cold-applied adhesive. Maintain 75 mm (three inch) to 150 mm (six-inch) space between planks.

3.10 APPLICATION OF COATING

A. Apply coating on cap sheet and membrane flashings that do not meet solar reflectance requirements.

B. Apply coating to built-up roofing and base flashings according to manufacturer's written instructions by spray or roller.

C. Provide dry film thickness of minimum 20 mils (0.5 mm).

3.11 FIELD QUALITY CONTROL

A. Roofing Inspector: Owner will engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.

B. 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. Roofing Inspector's quality assurance inspections shall comply with criteria established in ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."

C. 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.

D. 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.

3.12 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.

END OF SECTION

SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Formed sheet metal work for flashing are specified in this section.

1.2 RELATED WORK

A. Composition base flashings and stripping in metal roof flanges: Section 07 51 00, BUILT-UP BITUMINOUS ROOFING COLD APPLIED.

B. Flashing components of factory finished roofing and wall systems:

C. Sealant compound and installation: Section 07 92 00, JOINT SEALANTS.

D. Color of factory coated metal and anodized aluminum: Section 09 06 00, SCHEDULE FOR FINISHES.

E. Integral flashing component of manufactured roof specialties and accessories or equipment: Section 07 71 00, ROOF SPECIALTIES , and Division 22, PLUMBING.

F. Paint materials and application: Section 09 91 00, PAINTING.

G. Flashing of Roof Drains: Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING Section 22 11 00, FACILITY WATER DISTRIBUTION Section 22 13 00, FACILITY SANITARY SEWERAGE Section 22 14 00, FACILITY STORM DRAINAGE .

1.3 SUBMITTALS

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

B. Shop Drawings:
1. Flashings
2. Copings
4. Expansion joints
5. Fascia-cant

Manufacturer's Literature and Data:
6. Two-piece counterflashing
7. Thru wall flashing
8. Nonreinforced, elastomeric sheeting
9. Copper clad stainless steel
10. Polyethylene coated copper
11. Bituminous coated copper
12. Copper covered paper

C. Certificates: Stating that aluminum has been given - specified finish.

1.4 APPLICABLE PUBLICATIONS

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

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

A167-99(R 2004)	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
A653/A653M-07	Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process
B32-04	Solder Metal
B209-07	Aluminum and Aluminum-Alloy Sheet and Plate
B370-03	Copper Sheet and Strip for Building Construction
D173-03	Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
D412-06	Vulcanized Rubber and Thermoplastic Elastomers-Tension
D1187-97 (R2002)	Asphalt Base Emulsions for Use as Protective Coatings for Metal
D1784-07	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
D3656-07	Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
D4586-07	Asphalt Roof Cement, Asbestos Free

C. American National Standards Institute/Single Ply Roofing Institute (ANSI/SPRI):

ES-1-2003	Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual (2003 Edition).

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

AMP 500-505-88	Metal Finishes Manual

F. American Architectural Manufacturers Association (AAMA):

605-98	Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions Panels

G. Federal Specification (Fed. Spec):

A-A-1925A	Shield, Expansion; (Nail Anchors)
UU-B-790A	Building Paper, Vegetable Fiber

H. International Building Code (IBC):
1. 2007 Edition

PART 2 - PRODUCTS

2.1 MATERIALS

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.

B. Stainless Steel: ASTM A167, Type 302B, dead soft temper.

C. Copper ASTM B370, cold-rolled temper.

D. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m² (3 oz/sf). Bituminous coating shall weigh not less than 2 kg/m² (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Exposed fabric surface shall be crimped.

E. Copper Covered Paper: Fabricated of electro-deposit pure copper sheets ASTM B 370, bonded with special asphalt compound to both sides of creped, reinforced building paper, UU-B-790, Type I, style 5, or to a three ply sheet of asphalt impregnated creped paper. Grooves running along the width of sheet.

F. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m² (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.

G. Aluminum Sheet: ASTM B209, alloy 3003-H14. Except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14.

H. Galvanized Sheet: ASTM, A653.

I. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

J. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m²(6 lbs/100 sf).

K. Bituminous Paint: ASTM D1187, Type I.

L. Fasteners:
   1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
   2. Nails:
      a. Minimum diameter for copper nails: 3 mm (0.109 inch).
      b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
      c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
      d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
   3. Rivets: Not less than 3 mm (1/8 inch) diameter.
   4. Expansion Shields: Fed Spec A-A-1925A.

M. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.

N. Insect Screening: ASTM D3656, 18 by 18 regular mesh.

O. Roof Cement: ASTM D4586.

2.2 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:

B. Concealed Locations (Built into Construction):
   1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
   2. Stainless steel: 0.25 mm (0.010 inch) thick.
   3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.
   4. Galvanized steel: 0.5 mm (0.021 inch) thick.

C. Exposed Locations:
   1. Copper: 0.4 Kg (16 oz).
   2. Stainless steel: 0.4 mm (0.015 inch).
   3. Copper clad stainless steel: 0.4 mm (0.015 inch).

D. Thickness of aluminum or galvanized steel is specified with each item.

2.3 FABRICATION, GENERAL

A. Jointing:
   1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
   2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
   3. Joints shall conform to following requirements:
      a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
      b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
      c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
   4. Flat and lap joints shall be made in direction of flow.
   5. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
   6. Soldering:
      a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
      b. Wire brush to produce a bright surface before soldering lead coated copper.
      c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
      d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:
   1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
   2. Space joints as shown or as specified.
   3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
   4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
   5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
   6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:
   1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
   2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
   3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
   4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1.6 mm (0.0625 inch) thick aluminum.

E. Drips:
1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:
1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC 2003.

G. Metal Options:
1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.
3. Where copper gravel stops, copings and flashings will carry water onto cast stone, stone, or architectural concrete, or stainless steel.

2.4 FINISH

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.

B. In accordance with NAAMM Metal Finishes Manual, unless otherwise specified.

C. Finish exposed metal surfaces as follows, unless specified otherwise:
1. Copper: Mill finish.
2. Stainless Steel: Finish No. 2B or 2D.
3. Aluminum:
   a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
   b. Colored Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 18 mm (0.7 mils) thick. Dyes will not be accepted.
   c. Fluorocarbon Finish: AAMA 605, high performance organic coating.
   d. Mill finish.
4. Steel and Galvanized Steel:
   a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.
   b. Manufacturer's finish:

1) Baked on prime coat over a phosphate coating.
2) Baked-on prime and finish coat over a phosphate coating.
3) Fluorocarbon Finish: AAMA 605, high performance organic coating.

2.5 THROUGH-WALL FLASHINGS

A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
   1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
   2. Fabricate so keying nests at overlaps.

B. For Masonry Work When Concealed Except for Drip:
   1. Either copper, stainless steel, or copper clad stainless steel.
   2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
   3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.

C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
   1. Use same metal and thickness as counter flashing.
   2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
   3. Form exposed portion as snap lock receiver for counter flashing upper edge.

D. Window Sill Flashing and Lintel Flashing:
   1. Use either copper, stainless steel, copper clad stainless steel plane flat sheet, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
   2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
   3. Turn up back edge as shown.
   4. Form exposed portion with drip as specified or receiver.

E. Door Sill Flashing:
   1. Where concealed, use either 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.
   2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use either 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
   3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.6 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
   1. Use either copper, or stainless steel, thickness specified unless specified otherwise.
   2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
   3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
   4. Use either copper, or stainless steel at pipe flashings.

B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).

C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.

D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

E. Pipe Flashing: (Other than engine exhaust or flue stack)
   1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
   2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
   3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
      a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
      b. Allow for loose fit around and into the pipe.
   4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
      a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
      b. Allow for loose fit around pipe.

2.7 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Either copper or stainless steel, unless specified otherwise.

B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
   1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
   2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
   3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
   4. Manufactured assemblies may be used.
   5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
   6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.

C. One-piece Counterflashing:
   1. Back edge turned up and fabricate to lock into reglet in concrete.
   2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).

D. Two-Piece Counterflashing:
   1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
   2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:
   1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
   2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
   3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Pipe Counterflashing:
   1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
   2. Fabricate 100 mm (4 inch) over lap at end.
   3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
   4. Use stainless steel bolt on draw band tightening assembly.
   5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.8 BITUMEN STOPS

A. Fabricate bitumen stops for bituminous roofing edges for use with formed sheet metal gravel stops, pipe penetrations, and other penetrations through roof deck without a curb.

B. Fabricate with 19 mm (3/4 inch) vertical legs and 75 mm (3 inch) horizontal legs.

C. When used with gravel stop or metal base flashing use same metal for bitumen stop in thickness specified for concealed locations.

2.9 REGLETS

A. Fabricate reglets of one of the following materials:
   1. 0.4 Kg (16 ounce) copper.
   2. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
   3. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.

B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.

C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.

D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.

E. Fabricate mitered corners, fittings, and special shapes as may be required by details.

F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

2.10 ENGINE EXHAUST PIPE OR FLUE OR STACK FLASHING

A. Flashing at penetrations through roofing shall consist of a metal collar, sheet metal flashing sleeve and hood.

B. Fabricate collar with roof flange of 1.2 mm (0.047 inch) minimum thick black iron or galvanized steel sheet.
   1. Fabricate inside diameter of collar 100 mm (4 inches) larger than the outside diameter of the item penetration the roofing.
   2. Extend collar height from structural roof deck to not less than 350 mm (14 inches) above roof surface.

3. Fabricate collar roof flange not less than 100 mm (4 inches) wide.
4. Option: Collar may be of steel tubing 3 mm (0.125 inch) minimum wall thickness, with not less than four, 50 mm x 100 mm x 3 mm (2 inch by 4 inch by 0.125 inch) thick tabs bottom edge evenly spaced around tube in lieu of continuous roof flange. Full butt weld joints of collar.

C. Fabricate sleeve base flashing with roof flange of either copper, stainless steel, or copper clad stainless steel.
1. Fabricate sleeve roof flange not less than 100 mm (4 inches) wide.
2. Extend sleeve around collar up to top of collar.
3. Flange bottom of sleeve out not less than 13 mm (1/24 inch) and soldered to 100 mm (4 inch) wide flange to make watertight.
4. Fabricate interior diameter 50 mm (2 inch) greater than collar.

D. Fabricate hood counter flashing from same material and thickness as sleeve.
1. Fabricate the same as pipe counter flashing except allow not less than 100 mm (4 inch) lap below top of sleeve and to form vent space minimum of 100 mm (4 inch) wide.
2. Hem bottom edge of hood 13 mm (1/2 inch).
3. Provide a 50 mm (2 inch) deep drawband.

E. Fabricate insect screen closure between sleeve and hood. Secure screen to sleeve with sheet metal screws.

2.11 COPINGS

A. Fabricate of aluminum not less than 3.2 -mm 0.125 inch thick, type 6061 or 6063 (marine grade); , or 24 GA sheet metal as noted on drawings.

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 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.

G. Finish: Anodized or painted as specified.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.

5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.
7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:
    a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
    b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 THROUGH-WALL FLASHING

A. General:
1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches)and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.

7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).

B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.

C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).

D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.

E. Flashing at Veneer Walls:
    1. Install near line of finish floors over shelf angles or where shown.
    2. Turn up against sheathing.
    3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
    4. At concrete backing, extend flashing into reglet as specified.
    5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.

F. Lintel Flashing when not part of shelf angle flashing:
    1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
    2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
    3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.

G. Window Sill Flashing:
    1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
    2. Turn back edge up to terminate under window frame.
    3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.

H. Door Sill Flashing:

1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

I. Flashing at Masonry, Stone, or Precast Concrete Copings:
1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

3.3 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.
1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.

B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:
1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:

1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.
   a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
      1) Locate fasteners in masonry mortar joints.
      2) Use screws to sheet metal or wood.
   b. Fill joint at top with sealant.
4. Where flashing or hood is mounted on pipe.
   a. Secure with draw band tight against pipe.
   b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
   c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:
1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:
   a. Secure to face construction in accordance, with manufacturers instructions.
   b. Completely fill space at the top edge of receiver with sealant.
3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

E. When counter flashing is a component of other flashing install as shown.

3.5 REGLETS

A. Install reglets in a manner to provide a watertight installation.

B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.

C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:
1. Coordinate reglets for anchorage into concrete with formwork construction.
2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.6 COPINGS

A. General:
1. On walls topped with a wood plank, install a continuous edge strip on the front and rear edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.

B. Aluminum Coping:
1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
2. Install joint covers, centered at each joint, and securely lock in place.

C. Galvanized steel Copings:
   1. Join ends of sheets by a 19 mm (3/4 inch) locked seam with sealant, except at intervals of 9600 mm (32 feet), provide a 38 mm (1 1/2 inch) loose locked expansion joint filled with sealant or mastic.
   2. At straight runs between 7200 mm (24 feet) and 19200 mm (64 feet) locate expansion joint at center.
   3. At straight runs that exceed 9600 mm (32 feet) and form the leg of a corner locate the expansion joint not more than 4800 mm (16 feet) from the corner.

3.7 ENGINE EXHAUST PIPE OR STACK FLASHING

A. Set collar where shown and secure roof tabs or flange of collar to structural deck with 13 mm (1/2 inch) diameter bolts.

B. Set flange of sleeve base flashing not less than 100 mm (4 inch) beyond collar on all sides as specified for base flashing.

C. Install hood to above the top of the sleeve 50 mm (2 inch) and to extend from sleeve same distance as space between collar and sleeve beyond edge not sleeve:
   1. Install insect screen to fit between bottom edge of hood and side of sleeve.
   2. Set collar of hood in high temperature sealant and secure with one by 3 mm (1/8 inch) bolt on stainless steel draw band type, or stainless steel worm gear type clamp. Install sealant at top of head.

END OF SECTION

SECTION 07 71 00
ROOF SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies equipment supports.

1.2 RELATED WORK

A. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.

B. General insulation: Section 07 21 13, THERMAL INSULATION. 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. Federal Specifications (Fed. Spec.):
RR-G-1602D Grating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels)

C. American Society for Testing and Material (ASTM):
A653/A653M-02 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process
B209/209M-02 Aluminum and Aluminum Alloy-Sheet and Plate

B221/221M-02 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
C612-00 Mineral Fiber Block and Board Thermal Insulation
D1187-97 Asphalt-Base Emulsions for Use as Protective Coatings for Metal

D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series Metal Finishes Manual

E. American Architectural Manufacturers Association (AAMA):
605-98 High Performance Organic Coatings on Architectural Extrusions and Panels.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221/B221M.

B. Aluminum Sheet: ASTM B209/B209M.

C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.

D. Metal Grating for Roof Walkway: Fed. Spec. RR-G-1602.

2.2 EQUIPMENT SUPPORTS

A. Fabricate equipment supports from 1.3 mm (0.0516 inch) thick galvanized steel.

B. Form exterior curb with integral base, and deck closures for curbs installed on steel decking.

C. Use galvanized steel liners for curbs having inside dimension over 305 mm (12 inches).

D. Fabricate curb with a minimum height of 200 mm (8 inches) above roof surface.

E. Attach preservative treated wood nailers to top of curb. Use 50 mm (2 inch) by 50 mm (2 inch) minimum nominal size on curb with openings and 50 mm (2 inch) thick, width of curb up to 300 mm (12 inches) on equipment support curbs.

F. Make size of supports suit size of equipment furnished, with height as shown on drawings, but not less than 200 mm (8 inches) above roof surface.

2.3 FINISH

A. In accordance with NAAMM Amp 500 Series.

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.

E. Aluminum Colored Finish: AA-C22A42 (anodized or AA0C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1, Architectural, 0.7 mils thick Dyes will not be accepted.

F. Fluorocarbon Finish: AAMA 605.2 high performance organic coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof specialties 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.
   1. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
   2. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
   3. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).

F. Equipment Supports: Do not anchor to insulating concrete or metal deck. Anchor only to building structure as per manufacturers recommendations.

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 PROTECTION

A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION

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

B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

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

B. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS Section 23 37 00, AIR OUTLETS AND INLETS.

1.3 SUBMITTALS

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

B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.

C. List of FM, UL, or WH classification number of systems installed.

D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

1.4 DELIVERY AND STORAGE

A. Deliver materials in their original unopened containers with manufacturer's name and product identification.

B. Store in a location providing protection from damage and exposure to the elements.

1.5 WARRANTY

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

1.6 QUALITY ASSURANCE

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

1.7 APPLICABLE PUBLICATIONS

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

B. American Society for Testing and Materials (ASTM):
E84-07 Surface Burning Characteristics of Building Materials
E814-06 Fire Tests of Through-Penetration Fire Stops

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

Annual Issue Approval Guide Building Materials

D. Underwriters Laboratories, Inc. (UL):
Annual Issue Building Materials Directory
Annual Issue Fire Resistance Directory
1479-03 Fire Tests of Through-Penetration Firestops

E. Warnock Hersey (WH):
Annual Issue Certification Listings

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.

B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m^2 (16 sq. in.) in overall cross sectional area.

C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.

D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
1. Contain no flammable or toxic solvents.
2. Have no dangerous or flammable out gassing during the drying or curing of products.
3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
1. Classified for use with the particular type of penetrating material used.
2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.

F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.

G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

H. Materials to be asbestos free.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.

B. Use mineral fiber filler and bond breaker behind sealant.

C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with E84.

D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.

B. Remove insulation on insulated pipe for a distance of 150 mm (six inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

3.3 INSTALLATION

A. Do not begin work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.

B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.

C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP AND ACCEPTANCE OF WORK

A. As work on each floor is completed, remove materials, litter, and debris.

B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the Resident Engineer.

C. Clean up spills of liquid type materials.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

A. Sealing of site work concrete paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

B. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.

C. Glazing: Section 08 80 00, GLAZING.

D. Aluminum framed openings: Section 08 41 13, ALUMINUM FRAMED ENTRANCES AND STOREFRONTS, Section 08 51 13, ALUMINUM WINDOWS.

E. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.

F. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION .

1.3 QUALITY CONTROL:

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

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

D. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.

1.4 SUBMITTALS:

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

B. Manufacturer's installation instructions for each product used.

C. Cured samples of exposed sealants for each color where required to match adjacent material.

D. Manufacturer's Literature and Data:
   1. Caulking compound
   2. Primers
   3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 PROJECT CONDITIONS:

A. Environmental Limitations:
   1. Do not proceed with installation of joint sealants under following conditions:
      a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
      b. When joint substrates are wet.

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

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

1.6 DELIVERY, HANDLING, AND STORAGE:

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 5° C (40° F) or less than 32° C (90° F).

1.7 DEFINITIONS:

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Back-up Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.8 WARRANTY:

A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.

B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS:

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

B. American Society for Testing and Materials (ASTM):
   C509-06 Elastomeric Cellular Preformed Gasket and Sealing Material.

C612-04	Mineral Fiber Block and Board Thermal Insulation.
C717-07	Standard Terminology of Building Seals and Sealants.
C834-05	Latex Sealants.
C919-02.	Use of Sealants in Acoustical Applications.
C920-05	Elastomeric Joint Sealants.
C1021-08	Laboratories Engaged in Testing of Building Sealants.
C1193-05	Standard Guide for Use of Joint Sealants.
C1330-02 (R2007)	Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
D1056-07	Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
E84-08	Surface Burning Characteristics of Building Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS:

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

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

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

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

E. S-5:
1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade P.
5. Shore hardness of 15-45.

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

G. S-7:
   1. ASTM C920, silicone, neutral cure.
   2. Type S.
   3. Class 25.
   4. Grade NS.
   5. Shore A hardness of 25-30.
   6. Structural glazing application.

H. S-8:
   1. ASTM C920, silicone, acetoxy cure.
   2. Type S.
   3. Class 25.
   4. Grade NS.
   5. Shore A hardness of 25-30.
   6. Structural glazing application.

I. S-9:
   1. ASTM C920 silicone.
   2. Type S.
   3. Class 25.
   4. Grade NS.
   5. Shore A hardness of 25-30.
   6. Non-yellowing, mildew resistant.

J. S-10:
   1. ASTMC C920, coal tar extended fuel resistance polyurethane.
   2. Type M/S.
   3. Class 25.
   4. Grade P/NS.
   5. Shore A hardness of 15-20.

K. S-11:
   1. ASTM C920 polyurethane.
   2. Type M/S.
   3. Class 25.
   4. Grade P/NS.
   5. Shore A hardness of 35 to 50.

L. S-12:
   1. ASTM C920, polyurethane.
   2. Type M/S.
   3. Class 25, joint movement range of plus or minus 50 percent.
   4. Grade P/NS.
   5. Shore A hardness of 25 to 50.

2.2 CAULKING COMPOUND:

A. C-1: ASTM C834, acrylic latex.

B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

2.3 COLOR:

A. Sealants used with exposed masonry shall match color of mortar joints.

B. Sealants used with unpainted concrete shall match color of adjacent concrete.

C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.

D. Caulking shall be light gray or white, unless specified otherwise.

2.4 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
   1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

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

2.5 FILLER:

A. Mineral fiber board: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

2.7 CLEANERS-NON POUROUS SURFACES:

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

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

A. Prepare joints in accordance with manufacturer's instructions and SWRI.

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
   1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
   2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.
      1. Do not cut or damage joint edges.

C. 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.

D. 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.

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

3.3 BACKING INSTALLATION:

A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.

D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

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

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

3.4 SEALANT DEPTHS AND GEOMETRY:

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

A. General:
   1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
   2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
   3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
   4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
   5. Avoid dropping or smearing compound on adjacent surfaces.
   6. Fill joints solidly with compound and finish compound smooth.
   7. Tool joints to concave surface unless shown or specified otherwise.
   8. Finish paving or floor joints flush unless joint is otherwise detailed.
   9. Apply compounds with nozzle size to fit joint width.
   10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

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

C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
   1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
   2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
   3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
   4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
   5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 FIELD QUALITY CONTROL:

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
   1. Extent of Testing: Test completed elastomeric sealant joints as follows:
      a. Perform one test for each 300 m (1000 feet) of joint length thereafter or one test per each floor per elevation. 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. 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. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING:

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.

B. After filling and finishing joints, remove masking tape.

C. Leave adjacent surfaces in a clean and unstained condition.

3.8 LOCATIONS:

A. Exterior Building Joints, Horizontal and Vertical:
1. Metal to Metal: Type S-1, S-2
2. Metal to Masonry or Stone: Type S-1
3. Masonry to Masonry or Stone: Type S-1
4. Stone to Stone: Type S-1
5. Cast Stone to Cast Stone: Type S-1
6. Threshold Setting Bed: Type S-1, S-3, S-4
7. Masonry Expansion and Control Joints: Type S-6
8. Wood to Masonry: Type S-1

B. Metal Reglets and Flashings:
1. Flashings to Wall: Type S-6
2. Metal to Metal: Type S-6

C. Sanitary Joints:
1. Walls to Plumbing Fixtures: Type S-9
2. Counter Tops to Walls: Type S-9
3. Pipe Penetrations: Type S-9

D. Horizontal Traffic Joints:
1. Concrete Paving, Unit Pavers: Type S-11 or S-12
2. Garage/Parking Decks: Type S-10

E. High Temperature Joints over 204 degrees C (400 degrees F):
1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8

F. Interior Caulking:
   1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2 and C-3.
   2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1, C-2 and C-3.
   3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1, C-2 and C-3.
   4. Perimeter of Lead Faced Control Windows and Plaster or Gypsum Wallboard Walls: Types C-1, C-2 and C-3.
   5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.
   6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
   7. Concealed Acoustic Sealant Type S-4, C-1, C-2 and C-3.

END OF SECTION

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. Door Hardware: Section 08 71 00 , DOOR HARDWARE.

D. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.

E. Card readers and biometric devices: Section 28 13 16 , ACCESS CONTROL.

F. Intrusion Alarm: Section 28 16 11, INTRUSION DETECTION SYSTEM.

1.3 TESTING

A. An independent testing laboratory shall perform testing.

1.4 SUBMITTALS

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

B. 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 .
   2. Sound rated doors, including test report from Testing Laboratory.

1.5 SHIPMENT

A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.

B. Fasten temporary steel spreaders across the bottom of each door frame.

1.6 STORAGE AND HANDLING

A. Store doors and frames at the site under cover.

B. Protect from rust and damage during storage and erection until completion.

1.7 APPLICABLE PUBLICATIONS

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

B. 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 Thermal Transmittance of Steel Door and Frame Assemblies
128-1997 Acoustical Performance for Steel Door and Frame Assemblies
A250.8-03 Standard Steel Doors and Frames

E. American Society for Testing and Materials (ASTM):
A167-99(R2004) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
A568/568-M-07 Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled
A1008-08 Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability
B209/209M-07 Aluminum and Aluminum-Alloy Sheet and Plate
B221/221M-08 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
D1621-04 Compressive Properties of Rigid Cellular Plastics
D3656-07 Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns
E90-04 Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

F. The National Association Architectural Metal Manufactures (NAAMM):
Metal Finishes Manual (1988 Edition)

G. National Fire Protection Association (NFPA):
80-09 Fire Doors and Fire Windows

H. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory

I. Intertek Testing Services (ITS):
Certifications Listings…Latest Edition

J. 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. Aluminum Sheet: ASTM B209/209M.

E. Aluminum, Extruded: ASTM B221/221M.

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

2.2 FABRICATION GENERAL

A. GENERAL:
   1. Follow SDI 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 SDI 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.

B. Smoke Doors:
   1. Close top and vertical edges flush.
   2. Provide seamless vertical edges.
   3. Apply Steel astragal to the meeting style at the active leaf of pair of doors or double egress doors.
   4. Provide clearance at head, jamb and sill as specified in NFPA 80.

C. Fire Rated Doors (Labeled):
   1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
   2. Fire rated labels of metal, with raised or incised markings of approving laboratory shall be permanently attached to doors.
   3. Close top and vertical edges of doors flush. Vertical edges shall be seamless. Apply steel astragal to the meeting stile of the active leaf of pairs of fire rated doors, except where vertical rod exit devices are specified for both leaves swinging in the same direction.
   4. Construct fire rated doors in stairwell enclosures for maximum transmitted temperature rise of 230 °C (450 °F) above ambient temperature at end of 30 minutes of fire exposure when tested in accordance with ASTM E152.

2.3 METAL FRAMES

A. General:
   1. SDI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
   2. 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.
   4. Frames for doors specified to have automatic door operators; Security doors (Type 36); service window: minimum 1.7 mm (0.067 inch) thick.
   5. Knocked-down frames are not acceptable.

B. Reinforcement and Covers:
   1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
   2. Provide mortar guards securely fastened to back of hardware reinforcements except on lead-lined frames.

C. Terminated Stops: SDI A250.8.

D. Glazed Openings and Panel Opening :
   1. Integral stop on exterior, corridor, or secure side of door.

2. Design rabbet width and depth to receive glazing material or panel shown or specified.

E. Two piece frames:
1. One piece unequal leg finished rough buck sub-frames as shown, drilled for anchor bolts.
2. Unequal leg finished frames formed to fit subframes and secured to subframe legs with countersunk, flat head screws, spaced 300 mm (12 inches) on center at head and jambs on each side.
3. Preassemble at factory for alignment.

F. Frame Anchors:
1. Floor anchors:
   a. Where floor fills occur, provide extension type floor anchors to compensate for depth of fill.
   b. At bottom of jamb use 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts. Use 50 mm x 50 mm (2 inch by 2 inch) 9 mm by (3/8 inch) clip angle for lead lined frames, drilled for 9 mm (3/8 inch) floor bolts.
   c. Where mullions occur, provide 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two 6 mm (1/4 inch) floor bolts and frame anchor screws.
   d. Where sill sections occur, provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for 6 mm (1/4 inch) floor bolts and frame anchor screws. Space floor bolts at 50 mm (24 inches) on center.
2. Jamb anchors:
   a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority .
   b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
   c. Anchors 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

A. SDI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Plumb, align and brace frames securely until permanent anchors are set.
   1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
   2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
   3. Protect frame from accidental abuse.
   4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
   5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.

B. Floor Anchors:
   1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
   2. Power actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:

1. Anchors in masonry walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
2. 2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
3. 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

A. Install doors and hardware as specified in Sections Section 08 11 13 , HOLLOW METAL DOORS AND FRAMES Section 08 71 00 , DOOR HARDWARE .

END OF SECTION

SECTION 08 11 19.01
STAINLESS STEEL (SS) DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for all Stainless Steel (SS) Doors and Frames, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

C. Refer to Section 08 06 00 / Door, Frame and Hardware Schedule for indication of stainless steel (SS) doors and frames.

1.2 REFERENCES

A. ANSI:
   1. ANSI A151.1: "Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings".
   2. ANSI-A250.4 / SDI 100: "Recommended Specifications Standard Steel Doors and Frames".
   3. ANSI-A250.11 / SDI 105: "Recommended Erection Instructions for Steel Frames"
   4. ANSI-A250.4 for Physical Performance.

B. ASTM-A167: "Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip".

C. Fire rated doors and frames:
   1. UL or Warnock Hersey tested and listed as fire door assembly, with labels.
      a. Testing organization and label type acceptable to authority having jurisdiction.
   2. Comply with NFPA-80, "Fire Doors and Windows".
   3. ASTM-E2074: "Standard Methods of Fire Tests of Door Assemblies".
   4. Provide 450 degF temperature rise doors at stairs and other exit enclosures.
   5. Positive Pressure:
      a. Comply with Positive Pressure Requirements UL 10C, Category A.
      b. Provide "S" labels where required.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Provide infill panels, doors and frames from a single manufacturer who has specialized in stainless steel for not less than 3 years.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Drawings necessary for the fabrication and installation of stainless steel doors and frames.
   2. Schedule of doors and frames which is keyed to details, elevations, etc.
      a. Elevations and details of each opening..
   3. Provide depiction of specified finishes for review and approval.

B. Samples:
   1. Finishes and patterns: 10 IN square sheets of each finish and pattern.

C. Contract Closeout Information:
   1. Maintenance Data

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Stainless Steel Doors and Frames:
   1. Base:
      a. Next Door Company
   2. Optional:
      a. Ceco Door Products.
      b. Stiles Custom Metals Inc.
      c. Stainless Products, Inc.

B. Or Approved Equal.

2.2 FABRICATION - GENERAL

A. Materials:
   1. Steel: ASTM-A167, commercial quality type 304 stainless steel.
   2. Doors and frames shall be integrally manufactured using prime stainless steel.
      a. No cladding or substrate will be allowed.
   3. All internal components, reinforcements, anchorages, shall be fabricated from stainless steel, the same type as face sheets and frames.
      a. Other types of stainless steel and non-stainless steel will not be acceptable.

B. Fabricate in compliance with referenced standards, except where exceeded by the requirements of this Specification.

C. Fabricate rigid, neat in appearance and free from defects.

D. Form to indicated sizes and profiles.

E. Door and frame reinforcements for builder's hardware:
   1. In accordance with hardware schedule, templates provided by hardware supplier and ANSI/DHI-A115 series "Specifications for Door and Frame Preparation".
   2. Locate finish hardware in accordance with ANSI A250.8.
   3. Hinge reinforcements: 1/4 IN x 10 IN long x 3/16 IN thick, stainless steel.
   4. Strike reinforcements: 12 GA stainless steel tabs.
   5. Closer and Overhead Stop reinforcements: 3/16 IN thick x 12 IN-long stainless steel strapping.
   6. Surface hardware reinforcements: 12 GA stainless steel.
   7. Dust covers: Minimum 22 GA stainless steel; provide behind all mortised hardware cutouts.

F. Welding:
   1. Weld anchors and reinforcements such that no weld marks are visible on any exposed surface.
   2. Comply with AWS D9.1: “Sheet Metal Welding Code”.
   3. Perform welding with gas tungsten arch (TIG) equipment, alloyed 308 stainless welding rods.
   4. Use certified welding operators.
   5. Maintain proper welding temperature to avoid discoloring adjacent metal.
   6. Clamp components in appropriate jigs to avoid alligatoring and warpage.
   7. Discolored, alligatored, or warped work will not be accepted.

G. Preparation for Shipping:
   1. Carton or crate doors to prevent damage in shipping and handling.

2. Apply PVC film or equivalent material to protect against damage after delivery and removal from shipping crates.

2.3 FABRICATION – SS DOORS

A. Comply with ANSI-A250.8 / SDI 100.

B. Determination of performance level for each door:
   1. Per following schedule, use the indicated Level of HM door indicated for its location, size and other listed criteria.
   2. Note: Some items below may not apply to subject project.

Schedule of HM Door Levels

Location	Additional Criteria	Use ANSI Level:	Miscellaneous
Exterior Doors (flush)	Openings where each leaf is less than 47 IN	Level 3 (Extra Heavy-duty)	Thermally Insulated
	Openings where one or more of the leaves exceeds 47 IN	Level 4 (Maximum-duty)	
Exterior Stile and Rail Doors	All	Level 3 (Extra Heavy-duty)	Thermally Insulated
Interior Doors	Non-fire rated	Level 2 (Heavy-duty)	--
	Fire rated	Level 2 (Heavy-duty)	Labeled as indicated (w/out astragal wherever possible)
	Wet / Humid areas	Level 3 (Extra Heavy-duty)	Moisture-resistant core - Fire-resistant were required

General Notes:

Refer to Door, Frame and Hardware Schedule for indication of the following:
1. Door type, I.e. flush versus stile & rail, lites etc.
2. For indication of door label required.

Refer to Plans for door locations.

C. Door Thickness:
   1. 1-3/4 IN.

D. HM Door Level, per ANSI-A250.8:
   1. Utilize the Schedule above to determine the minimum ANSI Level according to the location of each door.
   2. For each ANSI Level, comply with the following:
      a. Level 2, Heavy-duty, physical performance Level B.
         1) Face Sheet Thickness: 18 GA.
      b. Level 3, Extra Heavy-duty, physical performance Level A.
         1) Face Sheet Thickness: 16 GA.
      c. Level 4, Maximum-duty, physical performance Level A.
         1) Face Sheet Thickness: 14 GA.

E. Model, per ANSI-A250.8:
   1. Model 2, Seamless.

F. Vertical Door Edges:
   1. Lock Stile Edges: Beveled 1/8 IN per 2 IN.
      a. Exception for Inactive Leaves: Fabricate “inactive leaves” with a square edge at the lock stile edge. (Active leaves to be beveled per above.)
   2. Hinge Stiles Edge: Beveled 1/8 IN per 2 IN.

3. Exceptions for Double-Acting Doors: Provide convex, radiused edges at lock stiles and hinge stiles.

G. End channels at top and bottom of door:
1. Sheet thickness of channels: 16 GA Minimum.
2. Bottom channel: Flush or Inverted, manufacturer's option.
3. Top channel:
   a. Flush or Inverted, manufacturer's option.
   b. Exception: All Exterior doors to be constructed with flush top channels.

H. Core Type(s):
1. Interior Doors:
   a. Construct doors with honeycomb internal construction, permanently bonded to face skins.
2. Exterior Doors:
   a. Construct doors with polystyrene insulation cores, permanently bonded to face skins.
   b. See Plans for indication of exterior doors.
3. Interior/Exterior Doors which are Fire Rated:
   a. See Door Schedule for doors which are fire rated.
      1) Construct doors with vertical stainless steel stiffeners filled with mineral rock wool or similar insulation between stiffeners which complies with required fire label.
   b. Provide assemblies labeled by Underwriters Laboratory or Warnock Hersey, complying with NFPA-80, and tested in accordance with ASTM-E2074.

I. Lites:
1. Provide light kits which are labeled for intended opening.
2. Material: Stainless steel of same type as indicated for door.
3. Fixed Stop:
   a. Locate at exterior face.
   b. Integral to door.
4. Removable Stop:
   a. Locate on interior face.
   b. Screw-less snap-in stops or stops secured with stainless steel, countersunk Phillips head machine screws.

2.4 FABRICATION – SS FRAMES

A. General:
1. Miter or butt trim faces and joint with continuous face welds.
2. Miter or butt stops.
3. All corners, joints, and intersections to be fully welded, ground smooth, re-finished and re-polished to achieve specified finish.
   a. Split type frames and knock-down type frames are not acceptable.
4. Fabricate frames to profiles and configurations indicated.
5. Determination of steel gauge for each frame:
   a. Per following schedule, use the indicated minimum steel gauge as indicated for its location, size and other listed criteria.
   b. Note: Some of the items below may not apply to subject project.

Schedule of Stainless Steel Frames

Location	Criteria	Minimum Gauge of Frame
Exterior Frames	Where overall width of frame is less than 47 IN	14 GA (1.7mm)
	Where overall width of frame is greater than 47 IN	12 GA (2.5mm)
Interior Frames	Non-fire rated	16 GA (1.3mm)

	Fire rated	16 GA (1.3mm)
	Wet / Humid areas	16 GA (1.3mm)

General Notes:

Gauge of frame listed is "minimum". Use heavier gauge as required due to size, physical configuration or if required to meet fire label requirements.

Refer to Door, Frame and Hardware Schedule for indication of the following:

1. Frame type, I.e. double-rabbet, pair/single, etc.
2. For indication of door label required.

Refer to Plans for indication of frame locations.

6. Conceal fastenings.
7. Reinforce all corners and hardware cutouts.
8. Stainless steel boxes at back of hardware cut-outs, minimum 0.45 mm 0.018 IN welded to frame
9. Hospital Stops (terminated stops):
   a. Use where scheduled on Door and Hardware Schedule.
   b. Description:
      1) Cut out and fully welded.
      2) Height from floor:
         a) 5-1/2 IN.
      3) 45 Deg termination.

B. Lites for SS window frames:
   1. Provide light kits which are labeled for intended opening.
   2. Material: Stainless steel of same type as indicated for frame.
   3. Fixed Stop:
      a. Locate at exterior face.
      b. Integral to frame.
   4. Removable Stop:
      a. Locate on interior face.
      b. Screw-less snap-in stops or stops secured with stainless steel, countersunk Phillips head machine screws.

C. Silencers:
   1. Specified in Section 08 71 00.
   2. Quantity:
      a. Single frames: 3 at strike stop.
      b. Pair frames: 2 per door leaf at head stop.
   3. Space per manufacturer's recommendations.
   4. Use plastic plugs to keep holes clear during construction.

D. Floor Anchors: One per jamb, minimum 14 GA angle with 3/16 IN diameter holes in floor clip for bolting to floor; welded to back of frame.

E. Jamb Anchors in Stud Partitions:
   1. Zee-shaped clip, minimum 16 GA, welded to back of frame.
   2. Number of anchors:
      a. Up to 60 IN high: 2 jamb anchors.
      b. Over 60 IN up to 90 IN high: 4 jamb anchors.
      c. Over 90 IN up to 96 IN high: 5 jamb anchors.
      d. Over 96 IN high: 5 jamb anchors plus 1 for each 24 IN or fraction thereof over 96 IN.

2.5 FINISHES

A. Comply with NAAMM: “Metal Finishes Manual”.

B. Color:
   1. Silver.

C. Brushed Finish:
   1. NAAMM #4 brushed (satin) finish.
      a. Graining:
         1) Vertical Grain.

D. Weldments:
   1. Exposed spot welds or other weld marks on exposed surfaces are not acceptable.

2.6 DOOR TO FRAME CLEARANCES – INSTALLATION TOLLERANCES

A. Comply with the most stringent of the following:
   1. Door to Frame Clearances Table (following this paragraph).
   2. ANSI A250.8.
   3. NFPA 80.
   4. Building Code, as locally adopted and amended.

Door To Frame Clearances				
Rated / Non-rated	**Location**		**Wood Doors**	**SS & HM Doors**
Rated Openings	Top Rail to Frame		3/32 to 1/8 IN	3/32 to 5/32 IN
	Lock Stile to Jamb			
	Hinge Stile to Jamb			
	Meeting Stiles at Pair Doors		1/16 to 1/8 IN	1/16 to 1/8 IN
	Face of door to face of Stop			
	Door Bottom to Floor / Flooring	Typical; all floor covering types	Up to 1/2 IN	Up to 1/2 IN
		At Non-combustible Sills	Up to 3/8 IN	Up to 3/8 IN
		Bare floors; No flooring or sills	Up to 3/4 IN	Up to 3/4 IN
Non-rated Openings	All Conditions		Comply with criteria listed for rated openings	Comply with criteria listed for rated openings

2.7 MISCELLANEOUS

A. Overlapping Astragals - General:
   1. Provide approved overlapping astragals where required by label but not provided in Section 08 71 00 / Hardware.
   2. Finish: To match doors.
   3. Weatherstripping: Specified in Section 08 71 00.

B. Exterior Doors:
   1. Include fixed astragals of same type of stainless steel where required.
   2. Include necessary weatherstripping, thresholds, and sweeps.

C. Interior Doors:
   1. Include fixed astragals of same type of stainless steel where required to comply with required fire label.

D. Fire Labels:
   1. Affix permanent labels to fire rated units in accordance with agency requirements.

2. On openings where continuous hinges, or other items which would conceal label, are scheduled: Locate labels on alternative locations as allowed by listing agency and local authorities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that dimensions are correct and project conditions are suitable for installation.

B. Examine structure, substrates, and conditions under which work is to be installed for conditions detrimental to correct and timely completion.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
   2. Place frames prior to construction of enclosing walls and ceilings.
   3. Coordinate building in of anchors and frame grouting with other trades.

B. Placing Frames:
   1. General:
      a. Comply with provisions in SDI 105, unless otherwise indicated.
      b. Install fire-rated frames according to NFPA 80.
   2. Place frames before construction of adjacent walls.
      a. Exception: Where adjacent walls are cast-in-place concrete: Set frames after wall is constructed.
   3. Set frames accurately in position, plumbed, aligned, and braced securely.
   4. Do not remove spreaders until surrounding wall construction is completed.
   5. After surrounding walls have been constructed, verify that frames are still in proper alignment.
      a. Check for level, plumb, square, twist and other problems that will prevent proper fitting of doors.
      b. Correct deficiencies before surrounding construction is allowed to proceed.
   6. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

C. Frame-to-Wall Anchors:
   1. Utilize anchor type(s) specified for wall condition.
   2. Align anchors at hinge centers on hinge jamb and at corresponding heights on strike jamb.
   3. Secure frame to wall per manufacturer’s instructions.

D. Grout all frames set into Cast-in-Place Concrete, CMU, and other Masonry walls.
   1. Do not Grout frames set in to stud-framed wall types.

E. Door Installation:
   1. Comply with ANSI A250.8.
   2. Fit hollow-metal doors accurately in frames, within clearances specified.
   3. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

F. Seal frames to walls.

G. Install silencers.

3.3 ADJUSTING AND CLEANING

A. Verify Alignment:
   1. After surrounding walls have been constructed, verify that frames are still in proper alignment.
   2. Check for level, plumb, square, twist and other problems that will prevent proper fitting of doors.
   3. Correct deficiencies before surrounding construction is allowed to proceed.

B. Protection Removal:
   1. Immediately before final inspection, remove protective wrappings from doors and frames.

C. Clean doors and frames in accordance with manufacturer' s instructions.

D. Restore slight blemishes in finishes in accordance with manufacturer's instructions to match original finish.
   1. Remove and provide new doors and frames where repairs are not acceptable to the Architect.

E. Leave work complete and in proper operating condition.

F. Remove and replace defective work.

G. Ensure that all fire labels are intact, and readily visible.

END OF SECTION

SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Section specifies access doors or panels.

1.2 RELATED WORK:

A. Wire mesh and screen access doors: Section 05 50 00, METAL FABRICATIONS .

B. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.

C. Access doors in acoustical ceilings: Section 09 51 00, ACOUSTICAL CEILINGS.

D. Locations of access doors for duct work cleanouts: Section 23 31 00, HVAC DUCTS AND CASINGS Section 23 37 00, AIR OUTLETS AND INLETS.

1.3 SUBMITTALS:

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

B. Shop Drawings: Access doors, each type, showing construction, location and installation details.

C. Manufacturer's Literature and Data: Access doors, each type.

1.4 APPLICABLE PUBLICATIONS

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

B. American Society for Testing and Materials (ASTM):
A167-99(R-2004) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
A1008-07 Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy

C. American Welding Society (AWS):
D1.3-98 Structural Welding Code Sheet Steel

D. National Fire Protection Association (NFPA):
80-06 Fire Doors and Windows

E. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series Metal Finishes Manual

F. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory

PART 2 - PRODUCTS

2.1 FABRICATION, GENERAL

A. Fabricate components to be straight, square, flat and in same plane where required.
1. Slightly round exposed edges and without burrs, snags and sharp edges.

2. Exposed welds continuous and ground smooth.
3. Weld in accordance with AWS D1.3.

B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame. For fire rated doors, use hinges and locks as required by fire test.

C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on four sides to secure access door in opening. Provide anchors as required by fire test.

2.2 ACCESS DOORS, FIRE RATED:

A. Shall meet requirements for "B" label 1-1/2 hours with maximum temperature rise of 120 degree C (250 degrees F).

B. Comply with NFPA 80 and have Underwriters Laboratories Inc., or other nationally recognized laboratory label for Class B opening.

C. Door Panel: Form of 0.9 mm (0.0359 inch) thick stainless steel sheet, insulated sandwich type construction.

D. Frame: Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide frame flange at perimeter where installed in concrete masonry or gypsum board openings.
1. Weld exposed joints in flange and grind smooth.
2. Provide frame flange at perimeter where installed in concrete masonry or gypsum board.
3. Provide expanded galvanized metal lath perimeter wings when installed in plaster except veneer plaster.

E. Automatic Closing Device: Provide automatic closing device for door.

F. Hinge: Continuous steel hinge with stainless steel pin.

G. Lock:
1. Self-latching, with provision for fitting flush a standard screw-in type lock cylinder. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
2. Provide latch release device operable from inside of door. Mortise case in door.

H. Gasket: Type as required by fire test & UL listed product.

2.3 ACCESS DOORS, FLUSH PANEL:

A. Door Panel:
1. Form of 1.9 mm (0.0747 inch) thick steel or 1.5 mm (0.0598 inch) thick stainless steel (Wet areas or ceramic tile surfaces) sheet.
2. Reinforce to maintain flat surface.

B. Frame:
1. Form of 1.5 mm (0.0598 inch) thick stainless steel sheet of depth and configuration to suit material and type of construction where installed.
2. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
3. Weld exposed joints in flange and grind smooth.
4. Provide expanded galvanized metal lath perimeter wings when installed in plaster except veneer plaster.

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

D. Lock:
   1. Flush, screwdriver operated cam lock.

E. Gasket: Flame retardant polyurethane.

2.4 FINISH:

A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.

B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.

C. Stainless Steel: No. 4 for exposed surfaces.

2.5 SIZE:

A. Minimum 600 mm (24 inches) square door unless otherwise shown or required to suit opening in suspension system of ceiling, or as required to allow inspection of items served.

PART 3 - EXECUTION

3.1 LOCATION:

A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.

B. Use fire rated doors in fire rated partitions and ceilings.

C. Use flush panels in partitions and gypsum board or plaster ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

3.2 INSTALLATION, GENERAL:

A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.

B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.

C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.

3.3 ANCHORAGE:

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

B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.

C. Anchors for fire rated access doors shall meet requirements of applicable fire test.

3.4 ADJUSTMENT:

A. Adjust hardware so that door panel will open freely.

B. Adjust door when closed so door panel is centered in the frame.

END OF SECTION

SECTION 08 34 25.01
CHEMICAL RESISTANT DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for all Chemical Resistant Doors, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Fitting tolerances:
   1. 1/8 IN clearance at jambs, heads and meeting stiles.
   2. 1/2 IN clearance at bottom.

1.3 SUBMITTALS

A. Shop drawings.

B. Contract closeout information:
   1. Warranty.

1.4 WARRANTY

A. Manufacturer five (5) year warranty covering repair or replacement resulting from defects in material or workmanship including:
   1. Corrosion failure.
   2. Warp or twist of , 1/4 IN or more.
   3. Other defects which may impair or affect performance of door for purpose intended.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Chemical resistant doors:
   1. Base:
      a. Chem-Pruf Door.

B. Or Approved Equal.

2.2 MATERIALS

A. Doors:
   1. Flush, fiberglass reinforced plastic (FRP) using polymers formulated to environment.
   2. Minimum glass content: 35 percent by weight.
   3. Thickness: 1-3/4 IN.
   4. Reinforcing: Mild steel plates and treated wood.
   5. Stiles and rails: Built-up of layers of fiberglass and resins.
   6. Resins: Fire retardant; Class A flame spread.
   7. Lights:
      a. Molded in, of size indicated.

b. Glazing: Tempered glass.
c. Setting material: Silicone calk.

B. Frames: Stainless steel; type 304.
1. Reinforced for hardware as required.

C. Hardware:
1. Stainless steel only.
2. See Section 08 71 00 for hardware types and keying.

2.3 FABRICATION

A. Machine doors for application of hardware.

B. Factory bevel vertical edges, 1/8 IN in 2 IN.

C. Seal field cuts.

D. Fire Labels:
1. Affix permanent labels to fire rated units in accordance with agency requirements.
2. On openings where continuous hinges, or other items which would conceal label, are scheduled: Locate labels on alternative locations as allowed by listing agency and local authorities.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of openings to accept installation.

B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Do not hang damaged, warped, or stained doors.

B. Condition doors to prevailing humidity prior to hanging.

C. Fit doors to frames and machine for hardware, to whatever extent not previously worked at factory.

D. Install doors in accord with manufacturer's instructions, and as indicated.

E. Install with corrosion resistant anchors.

F. Adjust for proper fit and uniform clearance.

G. Ensure that all fire labels are intact, and readily visible.

END OF SECTION

SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies aluminum entrance work including storefront construction, hung doors, interior ICU sliding 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, door closer reinforcement internal reinforcement and insulation, of flush panel door.
   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):

B209-06	Aluminum and Aluminum-Alloy Sheet and Plate
B221-05	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	Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
F468-06	Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
F593-04	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):
2604-05 High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels

E. American Welding Society (AWS):
D1.2-03 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 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 x 10-50 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

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. (Interior)
   2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3. (Exterior)

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.
   2. Color Finish: Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 7 mils thick. More than 50 percent variation of the maximum shade range approved will not be accepted in a single component or in adjacent components, stiles, and rails on a continuous series.

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:

A. After installation of entrance and storefront work is completed, adjust and lubricate operating mechanisms to insure proper performance.

3.3 PROTECTION, CLEANING AND REPAIRING:

A. 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.

END OF SECTION

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Aluminum windows of type and size shown, complete with hardware, related components and accessories.

B. Types:
   1. Fixed

1.2 DEFINITIONS

A. Accessories: Mullions, staff beads, casings, closures, trim, moldings, panning systems, sub-sills, clips anchors, fasteners, weather-stripping, insect screens and other necessary components required for fabrication and installation of window units.

B. Uncontrolled Water: Water not drained to the exterior, or water appearing on the room side of the window.

1.3 RELATED WORK

A. Storefront: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.

B. Glazing: Section 08 80 00, GLAZING.

C. Color of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect windows from damage during handling and construction operations before, during and after installation.

B. Store windows under cover, setting upright.

C. Do not stack windows flat.

D. Do not lay building materials or equipment on windows.

1.5 QUALITY ASSURANCE

A. Approval by contracting officer is required of products or service of proposed manufacturers and installers.

B. Approval will be based on submission of certification by Contractor that:
   1. Manufacturer regularly and presently manufactures the specified windows as one of its principal products.
   2. Installer has technical qualifications, experience, trained personnel and facilities to install specified items.

C. Provide each type of window produced from one source of manufacture.

D. Quality Certified Labels or certificate:
   1. Architectural Aluminum Manufacturers Association, "AAMA label" affixed to each window indicating compliance with specification.

2. Certificates in lieu of label with copy of recent test report (not more than 4 years old) from an independent testing laboratory and certificate signed by window manufacturer stating that windows provided comply with specified requirements and AAMA 101/I.S.2 for type of window specified.

1.6 SUBMITTAL

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

B. Shop Drawings:
   1. Minimum of 1/2 full scale types of windows on project .
   2. Identifying parts of window units by name and kind of metal or material, show construction, locking systems, trim, installation and anchorages.
   3. Include glazing details and standards for factory glazed units.

C. Manufacturer's Literature and Data:
   1. Window.
   2. Sash locks, keepers, and key.

D. Certificates:
   1. Certificates as specified in paragraph QUALITY ASSURANCE.
   2. Indicating manufacturers and installers qualifications.
   3. Manufacturer's Certification that windows delivered to project are identical to windows tested.

E. Test Reports:

F. Copies of test reports as specified in paragraph QUALITY ASSURANCE.

G. Samples: Provide 150 mm (six-inch) length samples showing finishes, specified.

1.7 WARRANTY

A. Warrant windows against malfunctions due to defects in thermal breaks, hardware, materials and workmanship, subject to the terms of Article “WARRANTY OF CONSTRUCTION”, FAR clause 52.246-21, except provide 10 year warranty period.

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 Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

90.1-04	Energy Standard of Buildings

C. American Architectural Manufacturers Association (AAMA):

101/I.S.2/A440-05	Windows, Doors, and Unit Skylights
505-98	Dry Shrinkage and Composite Performance Thermal Cycling Test Procedures
2605-05	Superior Performing Organic Coatings on Architectural Aluminum Extrusions and Panels
TIR-A8-04	Structural Performance of Poured and Debridged Framing Systems

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

A653/A653M-07	Steel Sheet, Zinc Coated (Galvanized), Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-dip Process
E 90-04	Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

E. National Fenestration Rating Council (NFRC):

NFRC 100-04	Determining Fenestration Product U-Factors
NFRC 200-04	Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

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

AMP 500 Series	Metal Finishes Manual

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions; Sheet and Plate: AAMA 101/I.S.2.

B. Weather-strips: AAMA 101/I.S.2; except leaf type weather-stripping is not permitted.

C. Fasteners: AAMA 101/I.S.2. Screws, bolts, nuts, rivets and other fastening devices to be non-magnetic stainless steel.
   1. Fasteners to be concealed when window is closed. Where wall thickness is less than 3 mm (0.125 inch) thick, provide backup plates or similar reinforcements for fasteners.
   2. Stainless steel self tapping screws may be used to secure Venetian blind hanger clips, vent guide blocks, friction adjuster, and limit opening device.
   3. Attach locking and hold-open devices to windows with concealed fasteners. Provide reinforcing plates where wall thickness is less than 3 mm (0.125 inch) thick.

D. Weather-strips: AAMA 101/I.S.2.

2.2 THERMAL AND CONDENSATION PERFORMANCE

A. Thermal Transmittance:
   1. Maximum U value class for insulating glass windows: 50 (U=0.50).
   2. Maximum U value class for dual glazed windows: 70 (U=0.70), or as required by ASHRAE 90.1.

B. Solar Heat Gain Coefficient (SHGC): SHGC shall comply with State or local energy code requirement.

2.3 FABRICATION

A. Fabrication to exceed or meet requirements of Physical Load Tests, Air Infiltration Test, and Water Resistance Test of AAMA 101/I.S.2.

B. Glazing:
   1. Factory or field glazing optional.
   2. Glaze in accordance with Section 08 80 00, GLAZING.
   3. Windows reglazable without dismantling sash framing.
   4. Design rabbet to suit glass thickness and glazing method specified.
   5. Glaze from interior except where not accessible.
   6. Provide removable fin type glazing beads.

C. Trim:
   1. Trim includes casings, closures, and panning.
   2. Fabricate to shapes shown of aluminum not less than 1.6 mm (0.062 inch) thick
   3. Extruded or formed sections, straight, true, and smooth on exposed surfaces.
   4. Exposed external corners mitered and internal corners coped; fitted with hairline joints.
   5. Reinforce 1.6 mm (0.062 inch) thick members with not less than 3 mm (1/8-inch) thick aluminum.

6. Except for strap anchors, provide reinforcing for fastening near ends and at intervals not more than 305 mm (12 inches) between ends.
7. Design to allow unrestricted expansion and contraction of members and window frames.
8. Secure to window frames with machine screws or expansion rivets.
9. Exposed screws, fasteners or pop rivets are not acceptable on exterior of the casing or trim cover system.

D. Thermal-Break Construction:
1. Manufacturer's Standard.
2. Low conductance thermal barrier.
3. Capable of structurally holding sash in position and together.
4. All Thermal Break Assemblies (Pour & Debridge, Insulbar or others) shall be tested as per AAMA TIR A8 and AAMA 505 for Dry Shrinkage and Composite Performance.
5. Location of thermal barrier and design of window shall be such that, in closed position, outside air shall not come in direct contact with interior frame of the window.

E. Mullions: AAMA 101.

F. Subsills and Stools:
1. Fabricate to shapes shown of not less than 2 mm (0.080 inch) thick extruded aluminum.
2. One piece full length of opening with concealed anchors.
3. Sills turned up back edge not less than 6 mm (1/4 inch). Front edge provide with drip.
4. Sill back edge behind face of window frame. Do not extend to interior surface or bridge thermal breaks.
5. Do not perforate for anchorage, clip screws, or other requirements.

2.4 FIXED WINDOWS

A. AMMA 101/I.S.2; Type HC25 .

B. AAMA certified product to the AAMA 101/I.S.2. - 97 standard.

2.5 FINISH

A. In accordance with NAAMM AMP 500 series.

B. Finish exposed aluminum surfaces as follows:
1. Anodized Aluminum:
a. Finish in accordance with AMP 501 letters and numbers.
b. Clear anodized Finish: AA-C22A41 Medium matte, clear anodic coating, Class 1 Architectural, 0.7 mils thick.

C. Hardware: Finish hardware exposed when window is in the closed position: Match window color.

PART 3 - EXECUTION

3.1 PROTECTION (DISSIMILAR MATERIALS)

A. AAMA 101/I.S.2.

3.2 INSTALLATION, GENERAL

A. Install window units in accordance with manufacturer's specifications and recommendations for installation of window units, hardware, operators and other components of work.

B. Where type, size or spacing of fastenings for securing window accessories or equipment to building construction is not shown or specified, use expansion or toggle bolts or screws, as best suited to construction material.
   1. Provide bolts or screws minimum 6 mm (1/4-inch) in diameter.
   2. Sized and spaced to resist the tensile and shear loads imposed.
   3. Do not use exposed fasteners on exterior, except when unavoidable for application of hardware.
   4. Provide non-magnetic stainless steel Phillips flat-head machine screws for exposed fasteners, where required, or special tamper-proof fasteners.
   5. Locate fasteners to not disturb the thermal break construction of windows.

C. Set windows plumb, level, true, and in alignment; without warp or rack of frames or sash.

D. Anchor windows on four sides with anchor clips or fin trim.
   1. Do not allow anchor clips to bridge thermal breaks.
   2. Use separate clips for each side of thermal breaks.
   3. Make connections to allow for thermal and other movements.
   4. Do not allow building load to bear on windows.
   5. Use manufacturer's standard clips at corners and not over 600 mm (24 inches) on center.
   6. Where fin trim anchorage is shown build into adjacent construction, anchoring at corners and not over 600 mm (24 inches) on center.

E. Sills and Stools:
   1. Set in bed of mortar or other compound to fully support, true to line shown.
   2. Do not extend sill to inside window surface or past thermal break.
   3. Leave space for sealants at ends and to window frame unless shown otherwise.

3.3 MULLIONS CLOSURES, TRIM, AND PANNING

A. Cut mullion full height of opening and anchor directly to window frame on each side.

B. Closures, Trim, and Panning: External corners mitered and internal corners coped, fitted with hairline, tightly closed joints.

C. Secure to concrete or solid masonry with expansion bolts, expansion rivets, split shank drive bolts, or powder actuated drive pins.

D. Toggle bolt to hollow masonry units. Screwed to wood or metal.

E. Fasten except for strap anchors, near ends and corners and at intervals not more than 300 mm (12 inches) between.

F. Seal units following installation to provide weathertight system.

3.4 ADJUST AND CLEAN

A. Adjust ventilating sash and hardware to provide tight fit at contact points, and at weather-stripping for smooth operation and weathertight closure.

B. Clean aluminum surfaces promptly after installation of windows, exercising care to avoid damage to protective coatings and finishes.

C. Remove excess glazing and sealant compounds, dirt, and other substances.

D. Lubricate hardware and moving parts.

E. Clean glass promptly after installation of windows. Remove glazing and sealant compound, dirt and other substances.

F. Except when a window is being adjusted or tested, keep locked in the closed position during the progress of work on the project.

END OF SECTION

SECTION 08 51 23
STEEL WINDOWS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Section Includes:
   1. Steel windows, type and sizes as shown.
   2. Hardware.
   3. Accessories including, but not limited to, following:
      a. Mullions, closures, trim, weather-stripping, covers, insect screens, anchors, clips, fasteners, and other components necessary for fabrication and installation complete of windows as specified.

1.2 RELATED WORK:

A. Sealing Joints: Section 07 92 00, JOINT SEALANTS.

B. Glazing: Section 08 80 00, GLAZING.

C. Finish Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 QUALITY CONTROL

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. Manufacturer who regularly and presently, manufactures and installs steel window units and related accessories as one of its principal products.
      b. Accessories required for windows shall be manufacturer's standard or those of other manufacturers regularly engaged in making window accessories and acceptable to window manufacturer.
         1) Items shall be of materials which shall be compatible with balance of window unit material, and construction shall be that which shall give desired functional service.
   2. Installer: Approved in writing by manufacturer.

1.4 SUBMITTALS:

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

B. Product Data: Furnish for each type of window required, including:
   1. Construction details and fabrication methods.
   2. Profiles and dimensions of individual components.
   3. Data on hardware, including sweep lock, keeper, lift handles, accessories, and finishes.
   4. Recommendations for maintenance and cleaning of window surfaces.

C. Shop Drawings: Furnish for each type window included in project.
   1. Layout and installation details, including anchors, support framing and sheet metal trim members.
   2. Elevations of continuous work at 1:50 (1/4 inch) scale and typical window unit elevations at 1:20 (3/4 inch) scale.
   3. Full-size section details of typical composite members, including reinforcement.

4. Hardware.
5. Accessories.
6. Glazing details.
7. Color charts for standard finishes and sealants.

D. Samples:
1. Typical sash corner.
2. Typical muntin section.
3. For Initial Color Selection: Submit samples of each specified finish on 300 mm (12 inch) long sections of window members.
4. Hardware.

E. Quality Control Submittals:
1. Test Reports: Window manufacturer provide certified test report from a qualified independent testing laboratory engaged in testing windows to verify that his steel window assembly has been tested in accordance with specified test procedures and products comply with these minimum test performance characteristics indicated. Test reports shall have been made within current year.
2. Manufacturer's Certificates:
   a. Stating steel members have been given specified thickness of prime coat and/or organic coating finish.
   b. Indicating manufacturer's and installer's meet qualifications as specified.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Comply with applicable recommendations of Steel Window Institute.

B. Deliver steel window units and related components in manufacturer's original, unopened protective packaging labeled for identification with manufacturer's name and brand and contents. Use padded blankets or other approved protective wrapping for glass, decorative metal work, and other exposed elements.
1. Do not deliver steel window units until work is ready for their installation.
2. Inspect components for damage upon delivery. Do not install steel window units with dimples or dents. Remove and replace damaged components at no additional cost.

C. Storage: Store steel window units and related components, in positions necessary to prevent twisting, in weathertight and dry storage facility in their original shipping containers with protective wrapping or packaging securely in place, in accordance with manufacturers written instructions.

D. Protect finish from damage from handling, weather and construction operations before, during and after installation.

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 National Standards Institute (ANSI):

Z97.1-04	Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.

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

A123-02	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
B633-07	Electrodeposited Coatings of Zinc on Iron and Steel
C509-06	Elastomeric Cellular Preformed Gasket and Sealing Material.

D2287-96(2001)	Non-rigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
E283-04	Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across Specimen.
E331-00	Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

D. National Fire Protection Association:
NFPA 80-06. Standard for Fire Doors and Windows.

E. Steel Structures Painting Council (SSPC):
SSPC-SP1... Solvent Cleaning.
SSPC-SP8... Pickling.

1.7 WARRANTY:

A. Warranty: Submit written warranty, in accordance with General Condition requirements except that warranty period shall be extended to include five (5) years.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Materials:
1. Frame: Formed from 2.3 mm (12 gauge) galvanized sheet steel.
2. Paint Finishes:
   a. Prime Coat: After fabrication, steel windows, fins, mullions, cover plates and associated parts shall be cleaned, properly treated, prime painted with manufacturer's standard prime paint.
   b. Factory Finish: After fabrication, for type of factory finish selected, steel windows and associated components shall be cleaned, and given following treatments:
      1) Pretreatment: Zinc phosphate treated.
      2) Primer: Manufacturer's special epoxy primer and oven cured.
      3) Finish Coat: Manufacturer's standard color coat finish and oven cured.
      4) Color: Refer to Section 09 06 00, SCHEDULE FOR FINISHES.
         a) Color of finish coat is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
         b) Touch-up abraded surfaces with enamel as specified for factory finish coat, except that it shall be Class A (Air-Drying), same as original.
   c. Zinc Coated Optional Finish: All steel except screens, shall be cleaned and:
      1) Hot dip galvanized (ASTM A123) and/or Electrodeposited (ASTM B633) or equivalent standards.
      2) Zinc coated, phosphate treated and prime painted.
      3) Zinc coated, phosphate treated, prime painted and factory finished in color as selected, from manufacturer's standard colors.
      4) Use galvanize repair compound where galvanized surfaces need field or shop repair. Apply compound in accordance with manufacturer's printed directions.
3. Glass and Glazing: As specified in Section 08 80 00, GLAZING.
   a. Windows shall be factory glazed prior to delivery to project site.
   b. Do not provide weep holes through glazed areas.

2.2 FABRICATION:

A. General: Fabricate steel windows in accordance with approved shop drawings. Form sections in one piece, straight, true and smooth. Prior to fabrication, all hot rolled steel sections shall be cleaned by shot blasting. Provide drips and weep holes in accordance with manufacturer's standard practice.
   1. Attachment of manufacturer's metal nameplates, shall not be permitted on any window surface.

B. Frame: Members shall be modified channel shapes. Corners of frame and ventilators shall be mitered or coped then solidly welded. Head and jamb members shall have integral screen-stops. Integrally roll continuous flange at jambs and heads to form a caulking stop between facing and backing masonry. Exposed and contact surfaces shall be finished smooth, flush, with adjacent surfaces.

C. Sills: Sills shall have stepped rebates to receive lower sash bottom rail, which shall be kept clear of sill wash. Sills shall not be perforated at any point in their full length. Weld strap anchors to underside of sill, or screw to tapped lugs welded thereto.

D. Sash: Rails shall be tubular. Stiles may be tubular or modified channel shape. Stiles and rails shall be formed in one piece from single strips. Make sash rebates minimum 15 mm (19/32 inch). Make interior horizontal top surfaces of both meeting rails flat and in same plane. Meeting rails shall have tight contact with wedge blocks at jambs when sash is closed. Cope, end-lap and weld all corners of sash.

E. Muntins: Steel tee muntin sections shall be tenoned and welded to perimeter frame. Muntin intersections shall be slotted and cross notched.

F. Glazing: Design windows for interior glazing. Provide continuous removable snap-in metal glazing beads to suit specified glazing.

G. Mullions: Provide manufacturer's standard or a structural shape mullion at multiple unit openings. Make mullions full height of opening and embed them to minimum depth of 125 mm (5 inches) into sill, or securely anchor at head and sill with zinc-coated sheet steel extensions, standard bent-clips or offset shapes of 1.7 mm (14 gauge) zinc-coated steel.

H. If windows and interior metal window trim are installed as complete units, mullions may be anchored at head by means of 5 mm (3/16 inch) steel plate clip bolted to mullion and welded to lintel, and supported at sill with 2.3 mm (12 gauge) zinc-coated steel bent clips welded to mullion.

I. Closures: Miter or cope closure corners and fit with tightly closed joints. Secure closures to window frames with non-corrosive machine screws or expansion rivets, and to masonry with fasteners specified.

J. Reinforcing: Reinforce window frames for attachment of screens, screen hardware or travel-limit lug. Full or limited length reinforcing plates shall be welded to back of frames, and shall be 3 mm (1/8 inch) thick and of sufficient width to securely hold fasteners.

K. Welding: Dress all exposed welds and joints, flush and smooth.

L. Fasteners for Anchoring: Where type, size or spacing of fasteners for securing windows and accessories to building construction is not shown or specified, use expansion or toggle bolts or screws, recommended by manufacturer for construction material adjacent to window units. Bolts or screws: Minimum 6 mm (1/4 inch) diameter and spaced not over 600 mm (24 inches) on centers.
   1. Expansion shield and bolt assemblies shall provide holding power beyond tensile and shearing strength of bolt.

2. Power actuated drive pins may be used for securing anchors to concrete if recommended by manufacturer.

2.3 INTERIOR METAL WINDOW TRIM:

A. Form window trim of zinc-coated sheet steel. Use 1.2 mm (18 gauge) for heads and jambs, 2.33 mm (12 gauge) for stools and 1.0 mm (20 gauge) for moldings.
   1. Make trim of welded assembly with hairline mitered corners, dressed flush and smooth. Trim to be used for plaster key, shall have flanges expanded or perforated and provided with attachments for anchorage. Slightly round exposed edges. Coat back side of trim to masonry. Make provisions for fastening of metal plastering base.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Window openings shall conform with details, dimensions and tolerances shown on window manufacturer's approved shop drawings.

B. Conditions which may adversely affect window installation shall be brought to Contractors attention, for repair, prior to commencement of window installation. Do not proceed with window installation until unsatisfactory conditions have been corrected.

C. Washdown of adjacent masonry shall be completed prior to erection of windows to prevent damage to window finish by cleaning materials.

3.2 INSTALLATION

A. General:
   1. Windows specified under this section shall be installed by experienced personnel as approved by window manufacturer.

B. Install windows in strict accordance with approved shop drawings.
   1. Set units plumb, level and true to line, without warp or rack of frames.
   2. Anchor units securely to surrounding construction with a minimum of three adjustable, asphalt coated or galvanized steel anchors with approved fasteners in accordance with manufacturer's recommendations.
   3. Exterior joints between sash, trim and mullions shall be properly sealed watertight with an approved sealant as specified in Section 07 92 00, JOINT SEALANTS, and neatly pointed. Finished work shall have weathertight joints.

C. Protect window equipment during construction.

D. Upon complete installation of all windows and accessories, and before acceptance of work, adjust all movable sash and operating mechanism for free and easy operation, and defects of any nature.

E. Furnish certificate, signed by both contractor and window manufacturer, stating that installation of windows was done by installers approved by manufacturer of windows.

3.3 PROTECTION:

A. Protect windows from damage until final inspection and acceptance.

END OF SECTION

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 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, if possible, 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 52.24-21, 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.

1.6 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23 plus 2 copies to the VAMC Locksmith (VISN Locksmith if the VAMC does not have a locksmith).

B. Hardware Schedule: Prepare and submit hardware schedule in the following form:

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 Resident Engineer for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in Resident Engineer's office until all other similar items have been installed in project, at which time the Resident Engineer 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. Manufacturers' Catalog Number References: Where manufacturers' products are specified herein, products of other manufacturers which are considered equivalent to those specified may be used. Manufacturers whose products are specified are identified by abbreviations as follows:

Adams-Rite	Adams Rite Mfg. Co.	Pomona, CA
Best	Best Access Systems	Indianapolis, IN
Don-Jo	Don-Jo Manufacturing	Sterling, MA
G.E. Security	GE Security, Inc.	Bradentown, FL
Markar	Markar Architectural Products	Pomona, CA
Pemko	Pemko Manufacturing Co.	Ventura, CA
Rixson	Rixson	Franklin Park, IL
Rockwood	Rockwood Manufacturing Co.	Rockwood, PA
Securitron	Securitron Magnalock Corp.	Sparks, NV
Southern Folger	Southern Folger Detention Equipment Co.	San Antonio, TX
Stanley	The Stanley Works	New Britain, CT
Tice	Tice Industries	Portland, OR
Trimco	Triangle Brass Mfg. Co.	Los Angeles, CA
Zero	Zero Weather Stripping Co.	New York, NY

C. Keying: All cylinders shall be keyed into existing Grand Master Key System . Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset . Cylinders shall be 6 or 7 pin type. Keying information shall be furnished at a later date by the Resident Engineer.

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
A156.12-05	Interconnected Locks and Latches
A156.13-05	Mortise Locks and Latches Series 1000
A156.14-07	Sliding and Folding Door Hardware
A156.15-06	Release Devices-Closer Holder, Electromagnetic and Electromechanical
A156.16-08	Auxiliary Hardware
A156.17-04	Self-Closing Hinges and Pivots
A156.18-06	Materials and Finishes
A156.20-06	Strap 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
A156.25-07	Electrified Locking Devices
A156.26-06	Continuous Hinges
A156.28-07	Master Keying Systems
A156.29-07	Exit Locks and Alarms
A156.30-03	High Security Cylinders
A156.31-07	Electric 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):
   1. Building Materials Directory (2008)

PART 2 - PRODUCTS

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: Aluminum.
   3. Base Metal for Hinges for Fire-Rated Assemblies: Steel.
   4. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
   5. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
   6. 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.

2.5 COMBINATION CLOSER – HOLDER

A. Conform to ANSI A156.15; combination closer-holder with built-in electronic release.

B. Combination closer-holder shall have the following features:
1. Control door closing and latching sequence by hydraulic action.
2. Wiring for 24V DC current. Current draw shall not exceed 0.16 amperes.
3. Combination closer-holder type:
   a. At doors with 90-110° hold-open point: Single lever arm with slide track closing action, and adjustable hydraulic back-check. Provide tracks with spring-cushion stop assemblies to avoid the necessity of a separate wall or floor stop. Provide with double egress arm where required.
   b. At doors with over 110° to 175° hold-open point: Single or double lever arm and adjustable hydraulic back-check. Provide with long arms where required for deep frame reveals.
4. Spring power for closing force shall conform to ANSI A156.4 and have 50% spring power adjustment.
5. Size closers per manufacturer's printed catalog recommendations.
6. Hold open mechanism shall hold door open between 85 degrees and 175 degrees depending on wall and frame conditions. Mount device to provide maximum door opening permitted by building construction or equipment.
7. Electronic release shall release door when signaled by smoke detector. Smoke detectors shall not be incorporated as an integral part of door holders. Smoke detectors are specified in the ELECTRICAL Section.
8. All closers to have full covers.
9. All closers shall have a 1 ½" minimum piston diameter and an adjustable back check position valve.

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 door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.

K. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

2.7 OVERHEAD DOOR STOPS AND HOLDERS

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

2.8 FLOOR DOOR HOLDERS

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

2.9 LOCKS AND LATCHES

A. 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 six pins . Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores.

B. In addition to above requirements, locks and latches shall comply with following requirements:

1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2. All locksets and latchsets, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design . 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.

2.10 ELECTROMAGNETIC LOCKS

A. ANSI/BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door. Listed under Category E in BHMA's "Certified Product Directory."
   1. Type: Full exterior or full interior, as required by application indicated.
   2. Strength Ranking: 1000 lbf (4448 N).
   3. Inductive Kickback Peak Voltage: Not more than 0 V.
   4. Residual Magnetism: Not more than 4 lbf (18 N) to separate door from magnet.

2.11 ELECTRIC STRIKES

A. ANSI/ BHMA A156.31 Grade 1.

B. General: Use fail-secure electric strikes at fire-rated doors.

C. HES 1006 series or equal.

2.12 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

2.13 KEY CABINET

A. ANSI Standard A156.5. Provide key cabinet made of cold rolled, 1.2 mm (0.0478 inch) thick furniture steel electro-welded. Doors shall have "no sag" continuous brass-pin piano type hinge and be equipped with chrome plated locking door handles, hook cam and mechanical pushbutton door lock. Key Cabinet and Key Control System shall accommodate all keys for this project plus 25 percent. Provide minimum number of multiple cabinets where a single cabinet of largest size will not accommodate the required number of keys.

B. Key tags shall consist of two sets: Permanent self-locking and loan key snaphook type with tag colors as follows: Red fiber marker of the permanent self-locking type approximately 32 mm (1-1/4 inch) in diameter engraved with the legend "FILE KEY MUST NOT BE LOANED." Also furnish for each hook a white cloverleaf key marker with snap-hooks engraved with the legend "LOAN KEY."

C. The manufacturer of the lock cylinders and locks shall attach a key tag to keys of each lock cylinder and shall mark thereon the respective item number and key change number. Provide each group of keys in a key gathering envelope (supplied by Key Cabinet Manufacturer) in which the lock manufacturer shall include the following information: Item number, key change number and door number. The contractor shall furnish the Key Cabinet Manufacturer the hardware and keying schedules and change keys.

D. The Key Cabinet Manufacturer shall set up a three-way cross index system, including master keys, listing the keys alphabetically, the hooks numerically and the key changes numerically on different colored index cards. Index cards shall be typewritten and inserted in a durable binder. Attach the keys to the two sets of numbered tags supplied with the cabinet. (The permanent tag and the loan key tag). Instruct the owner in proper use of the system. Install cabinet as directed by the Resident Engineer.

2.14 ARMOR PLATES, KICK PLATES AND MOP PLATES

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.

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. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.

D. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.

E. 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).

B. At interior doors, provide auto flush bolts less bottom bolt, unless otherwise specified, except at wood pairs with fire-rating greater than 20 minutes; provide fire pins as required by auto flush bolt and door fire labels.

2.18 DOOR PULLS

A. Conform to ANSI A156.6. Pull plate 90 mm by 350 mm (3-1/2 inches by 14 inches), unless otherwise specified. Cut plates of door pulls 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 J300 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 fame 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 ($0.000774 m^3/s/m$).

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, except as otherwise specified . 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 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.

2.27 FINISHES

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

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

C. Miscellaneous Finishes:
   1. Hinges --exterior doors: 626 or 630.
   2. Hinges --interior doors: 652 or 630.
   3. Pivots: Match door trim.
   4. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
   5. Thresholds: Mill finish aluminum.
   6. Cover plates for floor hinges and pivots: 630.
   7. Other primed steel hardware: 600.

D. 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.

E. Anti-microbial Coating: All hand-operated hardware (levers, pulls, push bars, push plates, paddles, and panic bars) shall be provided with an anti-microbial/anti-fungal coating that has passed ASTM E2180 tests. Coating to consist of ionic silver (Ag+). Silver ions surround bacterial cells, inhibiting growth of bacteria, mold, and mildew by blockading food and respiration supplies.

2.28 BASE METALS

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

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

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

A. For new buildings locate hardware on doors at heights specified below, with all hand-operated hardware centered within 864 mm (34 inches) to 1200 mm (48 inches), unless otherwise noted:

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. 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

E. 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.

F. After locks have been installed; show in presence of Resident Engineer 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 Resident Engineer 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.

ELECTRIC HARDWARE ABBREVIATIONS LEGEND:
ADO = Automatic Door Operator
EMCH = Electro-Mechanical Closer-Holder
MHO = Magnetic Hold-Open (wall- or floor-mounted)

B. INTERIOR SINGLE DOORS

HW-1A

Each Door to Have: RATED

1	Continuous Hinge	A51031B
1	Passage Latchset	TYPE AS REQUIRED
1	Closer	C02011/C02021 (PT4D, PT4F, PT4H) x INSTALL OUTSIDE ROOM
1	Kick Plate	J102
1	Mop Plate (@ Inswing Doors)	J102
1	Floor Stop	L02121 x 3 FASTENERS
1	Threshold	J32300 x 57 mm width (2-1/4 inches)
1	Door Sweep	90100CNB (PEMKO), OR EQUAL
1	Set Seals	R3C164

HW-1C

Each Door to Have: RATED

1	Continuous Hinge	A51031B
1	Passage Latchset	TYPE AS REQUIRED
1	Closer	C02011/C02021 (PT4D, PT4F, PT4H) x INSTALL OUTSIDE ROOM
1	Kick Plate	J102
1	Mop Plate (@ Inswing Doors)	J102
1	Floor Stop	L02121 x 3 FASTENERS
1	Threshold	J32300 x 57 mm width (2-1/4 inches)
1	Door Sweep	90100CNB (PEMKO), OR EQUAL
1	Set Seals	R3C164

HW-1F

Each Door to Have: NON-RATED

1	Continuous Hinge	A51031B
1	Passage Latchset	TYPE AS REQUIRED
1	Kick Plate	J102
1	Wall Stop	L52101 CONVEX
3	Silencers	L03011

HW-3E

Each Door to Have: NON-RATED

1	Continuous Transfer Hinge	A51031B x INTEGRAL HINGE GUARD CHANNEL x ADJUSTA-SCREWS x 4-THRUWIRETRANSFER x IN-HINGE ACCESS PANEL
1	Electrified Classroom Lock	TYPE AS REQUIRED, 24VDC
1	Key Cylinder	TYPE AS REQUIRED
1	Power Supply	Regulated, Filtered, 24VDC, Amperage as required
1	Closer	C02051/C02061 (PT4D, PT4H)
1	Floor Stop	L02121 x 3 FASTENERS
1	Set Self-Adhesive Seals	R0E154
1	Coat Hook	L03121
1	Alarm Contact	1078-G (G.E. Security), or Equal

OMIT COAT HOOK WHERE GLASS LITE PREVENTS INSTALLATION.

HW-4

Each Door to Have: NON-RATED

1	Continuous Hinge	A51031B
1	Classroom Lock	TYPE AS REQUIRED
1	Key Cylinder	TYPE AS REQUIRED
1	Overhead Stop	C04541
3	Silencers	L03011

HW-4B

Each Door to Have: NON-RATED/RATED

1	Continuous Hinge	A51031B
1	Public Restroom Lock	TYPE AS REQUIRED
1	Key Cylinder	TYPE AS REQUIRED
1	Closer	C02011/C02021 (PT4D, PT4F, PT4H)
1	Kick Plate	J102
1	Mop Plate (@ Inswing Doors)	J102
1	Floor Stop (@ Outswing Doors)	L02121 x 3 FASTENERS
1	Wall Stop (@ Inswing Doors)	L52101 CONVEX
1	Threshold	MARBLE (2-1/4 inches)
2	Sets Self-Adhesive Seals	R0E154

PROVIDE NON-HOLD-OPEN CLOSER AT TOILET ROOMS.

STONE THRESHOLD BY OTHER TRADES.

HW-4C

Each Door to Have:		RATED
1	Continuous Hinge	A51031B x INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Classroom Lock	TYPE AS REQUIRED
1	Key Cylinder	TYPE AS REQUIRED
1	Closer	C02011/C02021 (PT4D, PT4F, PT4H)
1	Armor Plate	J101 x 1.275 MM (0.050 INCH) THICKNESS
3	Silencers	L03011
1	Door Sweep	90100CNB (PEMKO), OR EQUAL

HW-5D

Each Door to Have:		NON-RATED
1	Continuous Hinge	A51031B
1	Storeroom Lock	TYPE AS REQUIRED
1	Key Cylinder	TYPE AS REQUIRED
1	Kick Plate	J102 (@ STORAGE, EVM, & HAC ROOMS ONLY)
1	Floor Stop (@ Inswing Doors)	L02121 x 3 FASTENERS
1	Wall Stop (@ Outswing Doors)	L52101 CONVEX
3	Silencers	L03011
1	Door Sweep	90100CNB (PEMKO), OR EQUAL

HW-5G

Each Door to Have:		NON-RATED
1	Continuous Hinge	A51031B
1	Storeroom Lock	TYPE AS REQUIRED
1	Key Cylinder	TYPE AS REQUIRED
1	Kick Plate	J102
1	Overhead Stop & Hold Open	C04541 x HEAVY DUTY x ADJUSTABLE x SURFACE MOUNTED
2	Sets Self-Adhesive Seals	R0E154

HW-6G

Each Door to Have:		NON-RATED
1	Continuous Transfer Hinge	A51031B x INTEGRAL HINGE GUARD CHANNEL x ADJUSTA-SCREWS x 4-THRUWIRETRANSFER x IN-HINGE ACCESS PANEL
1	Electrified Storeroom Lock	TYPE AS REQUIRED, 24VDC
1	Key Cylinder	TYPE AS REQUIRED
1	Power Supply	Regulated, Filtered, 24VDC, Amperage as required
1	Closer	C02011/C02021 (PT4D, PT4F, PT4H)
1	Wall Stop	L02121 x 3 FASTENERS
1	Threshold	J32300 x 57 mm width (2-1/4 inches)
1	Door Sweep	90100CNB (PEMKO), OR EQUAL
2	Sets Self-Adhesive Seals	R0E154
1	Drip	R0Y976
1	Dust Proof Strike	L04021
1	Alarm Contact	1078-G (G.E. Security), or Equal

HW-8E

Each [ADO] Pair to Have:		NON-RATED
2	Continuous Transfer Hinges	A51031B x INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS x 4-THRUWIRE TRANSFERS X IN-HINGE ACCESS PANEL
2	Push Plate	J304 8” x 16”
2	Hospital Grip	J401
2	Kick Plate	J102
2	Mop Plate (@ Inswing Doors)	J102
2	Floor Stop	L02121 x 3 FASTENERS
2	Silencers	L03011

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

POWER TRANSFERS FOR RE-ACTIVATION SENSOR WIRING (RE-ACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

HW-10

Each Pair to Have:		RATED
2	Continuous Transfer Hinges	A51031B x INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS x 4-THRUWIRE TRANSFERS X IN-HINGE ACCESS PANEL x 180 DEGREE SWING
1	Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1	Classroom Lock	TYPE AS REQUIRED
1	Key Cylinder	TYPE AS REQUIRED
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R5Y634 x R0E154 x THRU-BOLTS
2	Closers	C02011/C02021 (PT4D, PT4F, PT4H) x 180 SWING
2	Heavy-Duty Armor Plates	J101 x 3.175 MM (0.125 INCH) THICKNESS
1	Lock Trim Protector Bar	R111LPB-630 (ROCKWOOD), OR EQUAL
2	Wall Stops	(180 degree Swing) L5Z101 Convex
2	Set Self-Adhesive Seals	R0E154

INSTALL LOCK TRIM PROTECTOR BAR ON PUSH SIDE OF ACTIVE LEAF TO PROTECT LEVER TRIM.

HW-10A

Each [ADO] Pair to Have:		NON-RATED
1	Continuous Transfer Hinge	A51031B x INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS x 8-THRUWIRE TRANSFER X IN-HINGE ACCESS PANEL
1	Continuous Transfer Hinge	A51031B x INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS X 4-THRUWIRE TRANSFER X IN-HINGE ACCESS PANEL
1	Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1	Classroom Lock	TYPE AS REQUIRED
1	Key Cylinder	TYPE AS REQUIRED

1	Electric Unlatch Strike	MUNL (FAIL-SECURE), 24VDC (SECURITRON), OR EQUAL
1	Power Supply	Regulated, Filtered, 24VDC, Amperage as required
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R5Y634 x R0E154 x THRU-BOLTS
2	Armor Plates	J101 x 1.275 MM (0.050 INCH) THICKNESS
2	Floor Stops	L02121 x 3 FASTENERS
1	Threshold	J32300 x 57 mm width (2-1/4 inches)
2	Auto Door Bottoms	R0Y346 – HEAVY DUTY
2	Set Self-Adhesive Seals	R0E154

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

POWER TRANSFER SHARED BY ELECTRIC STRIKE AND RE-ACTIVATION SENSOR WIRING (RE-ACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

HW-10C

Each Pair to Have:		NON-RATED
2	Continuous Hinges	A51031B x INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1	Utility Lock	TYPE AS REQUIRED
1	Key Cylinder	TYPE AS REQUIRED
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R5Y634 x R0E154 x THRU-BOLTS
2	Closers/Hold Open	C02051/C02061 (PT4D, PT4H)
2	Kick Plates	J102
2	Floor Stops	L02121 x 3 FASTENERS
1	Set Self-Adhesive Seals	R0E154

HW-11C

Each Pair to Have:		RATED/NR
1	Continuous Hinge	A51031B
1	Set Auto Flush Bolts	TYPE 25 LESS BOTTOM BOLT
1	Storeroom Lock	TYPE AS REQUIRED

1	Key Cylinder	TYPE AS REQUIRED
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R5Y634 x R0E154 x THRU-BOLTS
2	Closers	C020S/C02061 (PT4D, PT4H)
2	Kick Plates	J102 (@ STORAGE ROOMS ONLY)
1	Threshold	J32300 x 57 mm width (2-1/4 inches)
2	Auto Door Bottoms	R0Y346 – HEAVY DUTY
2	Set Self-Adhesive Seals	R0E154

HW-E4

Each Door to Have: NON-RATED

1	Continuous Hinge	A51031B
1	Anti-Vandal Pull	1097HASP (TRIMCO), OR EQUAL
1	Exit Device	TYPE 1 F03 LES TRIM
1	Key Cylinder	TYPE AS REQUIRED
1	Closer	C02011 (PT4D, PT4F, PT4H)
1	Kick Plate	J102
1	Floor Stop	1214CK x 1268CK (TRIMCO), OR EQUAL
1	Threshold	J35130 x SILICONE GASKET
1	Door Sweep	90100CNB (PEMKO), OR EQUAL
1	Set Frame Seals	2891AS X CSK SCREWS (PEMKO), OR EQUAL
1	Drip	R0Y976
1	Alarm Contact	1078-G (G.E. Security), or Equal

HW-E8

Each Pair to Have: NON-RATED

1	Continuous Transfer Hinge	A51031B x INTEGRAL HINGE GUARD CHANNEL x ADJUSTA-SCREWS x 8-THRUWIRE TRANSFER x IN-HINGE ACCESS PANEL
1	Continuous Transfer Hinge	A51031B x INTEGRAL HINGE GUARD CHANNEL x ADJUSTA-SCREWS x 4-THRUWIRE TRANSFER x IN-HINGE ACCESS PANEL
1	Set Auto Flush Bolts	TYPE 25

1	Dust Proof Strike	L04021
1	Electrified Storeroom Lock	TYPE AS REQUIRED x RIGID OUTSIDE LEVER x KEY RETRACTS DEADBOLT AND LATCHBOLT (E01-REX, E06) 24 VDC
1	Key Cylinder	TYPE AS REQUIRED
1	Power Supply	Regulated, Filtered, 24VDC, Amperage as required
1	Overlapping Astragal with Self-Adhesive Seal	R5Y634 x R0E154 x THRU-BOLTS
1	Coordinator	TYPE 21A
2	Closer	C02051/C02061 (PT4D, PT4H)
2	Floor Stop	1214CK x 1268CK (TRIMCO), OR EQUAL
1	Threshold (outswing door)	J35130 x SILICONE GASKET
2	Door Sweep	90100CNB (PEMKO), OR EQUAL
1	Set Frame Seals	2891AS X CSK SCREWS (PEMKO), OR EQUAL
1	Drip	R0Y976
1	Alarm Contact	1078-G (G.E. Security), or Equal

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

C. INTERIOR SINGLE SECURITY DOORS

HW-SH-3

Each [AC, EL, REX, DPS] Door to Have:		NON-RATED
1	Continuous Transfer Hinge	A51031B x INTEGRAL HINGE GUARD CHANNELX ADJUSTA-SCREWS X 4-THRUWIRETRANSFER X IN-HINGE ACCESS PANEL
1	Electrified Storeroom Lock	TYPE AS REQUIRED, 24VDC

1	Power Supply	Regulated, Filtered, 24VDC, Amperage as required
1	Closer	C02011/C02021 (PT4D, PT4F, PT4H)
1	Floor Stop	L02121 x 3 FASTENERS
1	Door Sweep	90100CNB (PEMKO), OR EQUAL
2	Sets Self-Adhesive Seals	R0E154
1	Alarm Contact	1078-G (G.E. Security), or Equal

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

CARD READER BY DIVISION 28.

HW-SH-9

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

1	Continuous Transfer Hinge	A51031B x INTEGRAL HINGE GUARD CHANNELX ADJUSTA-SCREWS X 4-THRUWIRETRANSFER X IN-HINGE ACCESS PANEL
1	Set Auto Flush Bolts	TYPE 25
1	Dust Proof Strike	L04021
1	Electrified Storeroom Lock	TYPE AS REQUIRED, 24VDC
1	Power Supply	Regulated, Filtered, 24VDC, Amperage as required
1	Coordinator	TYPE 21A
1	Overlapping Astragal with Self-Adhesive Seal	R5Y634 x R0E154 x THRU-BOLTS
2	Closers	C02011/C02021 (PT4D, PT4F, PT4H)
1	Manual Flush Bolt	TYPE AS REQUIRED
2	Pull Handles	TYPE AS REQUIRED
2	Panic Exit Device	TYPE AS REQUIRED
2	Kick Plates	J102 (@ STORAGE ROOMS ONLY)
2	Floor Stops	L02121 x 3 FASTENERS
1	Set Self-Adhesive Seals	R0E154
2	Alarm Contacts	1078-G (G.E. Security), or Equal
1	Threshold	J32300

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

CARD READER BY DIVISION 28.

END OF SECTION

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 11, PHYSICAL ACCESS CONTROL SYSTEM (PACS).

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" Article in , GENERAL CONDITIONS, 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 Resident Engineer 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 five 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 SWING DOOR OPERATORS

A. General: Swing door operators shall be of institutional type, door panel size 600 mm to 1250 mm (2'-0" to 5'-0") width, weight not to exceed 300 kg (600 pounds), electric operated for overhead mounting within the header or transom. Furnish metal mounting supports, brackets and other accessories necessary for the installation of operators at the head of the door frames. The motor on automatic door operator shall be provided with an interlock so that the motor will not operate when doors are electrically locked from opening.

B. Operators shall have checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle. Operators shall be capable of recycling doors instantaneously to full open position from any point in the closing cycle when control switch is activated. Operators shall, when automatic power is interrupted or shut-off, permit doors to easily open manually without damage to automatic operator system.

C. Operator, enclosed in housing, shall open door by energizing motor and shall stop by electrically reducing voltage and stalling motor against mechanical stop. Door shall close by means of spring energy, and close force shall be controlled by gear system and motor being used as dynamic break without power, or controlled by hydraulic closer in electro-hydraulic operators. System shall operate as manual door control in event of power failure. Opening and closing speeds shall be adjustable:

1. Operator Housing: Housing shall be a minimum of 112 mm (4-1/2 inches) wide by 140 mm (5.5 inches) high aluminum extrusions with enclosed end caps for application to 100 mm (4 inches) and larger frame systems. All structural sections shall have a minimum thickness of 3.2 mm (0.125 inch) and be fabricated of a minimum of 6063-T5 aluminum alloy.
2. Power Operator: Completely assembled and sealed unit which shall include gear drive transmission, mechanical spring and bearings, all located in aluminum case and filled with special lubricant for extreme temperature conditions. Complete unit shall be rubber mounted with provisions for easy maintenance and replacement, without removing door from pivots or frame.
3. Connecting hardware shall have drive arm attached to door with a pin linkage rotating in a self-lubricating bearing. Door shall not pivot on shaft of operator.
4. Electrical Control: Operator shall have a self contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation and switching of power operator. All connecting harnesses shall have interlocking plugs.

2.2 MICROPRCESSOR 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.

2.3 POWER UNITS

A. 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 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. Manual Controls:
   1. Push Plate Wall Switch: Recess type, stainless steel push plate minimum 100 mm by 100 mm (four-inch by four-inch), with 13 mm (l/2-inch) high letters "To Operate Door--Push" engraved on face of plate.

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. At sliding doors, provide two photoelectric beams mounted at heights of 600 mm (24 inches) and 1200 mm (48 inches) in the door frame on sliding doors. Provide overhead safety presence sensors at door head on each side of the opening. Beams shall parallel door openings to prevent doors from closing when anyone is in the center of the door or doors. When beams are activated, doors shall recycle to full open position. Actuation shall include a motion detector mounted on each side of the door for detection of traffic in each direction.

C. Each swing door shall have installed on the pull side a presence sensor to detect any person standing in the door swing path and prevent the door from opening.

D. Time delay switches shall be adjustable between 3 to 60 seconds and shall control closing cycle of doors.

E. Decals with sign "In" or "Do Not Enter" shall be installed on both faces of each door where shown.

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 o£ 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 Resident Engineer.

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 operating, servicing and safety requirements for the swing and sliding automatic door operators.

B. Coordinate instruction to VA personnel with VA Resident Engineer.

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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. Sound resistant doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES .
   2. Mirrors: Section 10 28 00, TOILET, AND BATH, ACCESSORIES.
   3. Section 08 51 13, ALUMINUM WINDOWS .
   4. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES & STOREFRONTS.
   5. Color of spandrel glass, tinted (heat absorbing or light reducing) glass, and reflective (metallic coated) glass: Section 09 06 00, SCHEDULE FOR FINISHES.
   6. Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.
   7. 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 Resident Engineer.

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 applicable code.
   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 330.

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.

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. Transparent (one-way vision glass) mirrors.
   4. Elastic compound for metal sash glazing.
   5. Putty, for wood sash glazing.
   6. Glazing cushion.
   7. Sealing compound.

E. Samples:
   1. Size: 150 mm by 150 mm (6 inches by 6 inches).
   2. Tinted glass.
   3. Reflective glass.
   4. Transparent (one-way vision glass) mirrors.

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":
   1. Treat security glazing as fragile merchandise, and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling shall comply with Manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.

2. 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 for 10 years.
   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):

Z97.1-04	Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test.

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

C1363-05	Thermal Performance of Building Assemblies, by Means of A Hot Box Apparatus
C542-05	Lock-Strip Gaskets.
C716-06	Installing Lock-Strip Gaskets and Infill Glazing Materials.
C794-06	Adhesion-in-Peel of Elastomeric Joint Sealants.
C864-05	Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
C920-08	Elastomeric Joint Sealants.
C964-07	Standard Guide for Lock-Strip Gasket Glazing.
C1036-06	Flat Glass.
C1048-04	Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

C1172-09	Laminated Architectural Flat Glass.
C1376-10	Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
D635-06	Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastic in a Horizontal Position.
D4802-02	Poly (Methyl Methacrylate) Acrylic Plastic Sheet.
E84-09	Surface Burning Characteristics of Building Materials.
E330-02	Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
E2190-08	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; 1977, with 1984 Revision.

F. National Fire Protection Association (NFPA):
   80-08 Fire Doors and Windows.

G. National Fenestration Rating Council (NFRC)

H. Safety Glazing Certification Council (SGCC)2009:
   1. Certified Products Directory (Issued Semi-Annually).

I. Underwriters Laboratories, Inc. (UL):
   752-06 Bullet-Resisting Equipment.

J. Unified Facilities Criteria (UFC):
   4-010-01-2007 DOD Minimum Antiterrorism Standards for Buildings

K. Glass Association of North America (GANA):
   1. Glazing Manual (Latest Edition)
   2. Sealant Manual (2008)

L. American Society of Civil Engineers (ASCE):
   ASCE 7-10 Wind Load Provisions

PART 2 - PRODUCTS

2.1 GLASS

A. Use thickness stated unless specified otherwise in assemblies.
   Clear Glass:
      ASTM C1036, Type I, Class 1, Quality q4Thickness,1/4 inchor as indicated.
   Wired Flat Glass
      ASTM C1036, Type II, Class 1,Form 1, Pattern Pl, Finish F1, Quality m1Thickness,1/4 inch.

2.2 HEAT-TREATED GLASS

A. Clear Tempered Glass:
   1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
   2. Thickness, 6 mm (1/4 inch) or as indicated .

B. Tinted Tempered Glass.
   1. ASTM C1048, Kind FT, Condition A, Type I, Class 2, Quality q3.
   2. Color: RED Thickness, 6 mm (1/4 inch) or as indicated .

C. Tempered Patterned Glass (obscure or frosted):
   1. ASTM C1048, Kind FT, Type II, Class 1, Form 3, Quality q8, Finish f1, Pattern white frosted .
      Thickness0.422 inchor as indicated .

2.3 COATED GLASS

A. Low-E Tempered Glass:
   1. ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3 with low emissivity pyrolytic coating having an E of 0.15.
   2. Apply coating to second surface of insulating glass units.
   3. Thickness, 4.8 mm (3/16 inch) or as indicated .

2.4 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. Insulating Glass Unit Makeup
      a. Spacer
         1) Gas Fill: (Air)
   2. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
   3. 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.

2.5 GLAZING ACCESSORIES

A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.

B. Setting Blocks: ASTM C864:
   1. Channel shape; having 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 Clips: Galvanized steel spring wire designed to hold glass in position in rabbeted sash without stops.

F. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond shaped pieces, 6 mm (1/4 inch) minimum size.

G. 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.

H. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.

I. Glazing Sealants: ASTM C920, silicone neutral cure:
   1. Type S.
   2. Class 25
   3. Grade NS.
   4. Shore A hardness of 25 to 30 Durometer.

J. Neoprene, EPDM, or Vinyl Glazing Gasket: ASTM C864.
   1. Channel shape; flanges may terminate above the glazing channel or flush with the top of the channel.
   2. Designed for dry glazing.

K. Color:
   1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.
   2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.

L. 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. Patterned Glass:
   1. Install units with one patterned surface with smooth surface on the weather side.
   2. Install units in interior partitions with pattern in same direction in all openings.

G. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.

H. Laminated Glass:
   1. Tape edges to seal interlayer and protect from glazing sealants.
   2. Do not use putty or glazing compounds.

I. 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.

J. Fire Resistant Glass:
   1. Wire glass: Glaze in accordance with NFPA 80.
   2. Other fire resistant glass: Glaze in accordance with UL design requirements.

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

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

A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

C. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.

D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

F. Fill gap between glazing and stop with silicone type sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line. Sealant to be compatible with glazing tape compound.

G. Apply cap bead of silicone type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth. Sealant to be compatible with glazing tape compound.

3.6 INSTALLATION - WET METHOD (SEALANT AND SEALANT)

A. Place setting blocks at 1/4 points and install glazing pane or unit.

B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.

C. Fill gaps between glazing and stops with silicone type sealant to depth of bite on glazing, but not more than 9 mm (3/8 inch) below sight line to ensure full contact with glazing and continue the air and vapor seal. Sealant to be compatible with glazing tape compound.

D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

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

A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.

C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.

E. Fill gaps between pane and applied stop with silicone type sealant to depth equal to bite on glazing, to uniform and level line. Sealant to be compatible with glazing tape compound.

F. Trim protruding tape edge.

3.8 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)

A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 600 mm (24 inch) centers, kept 6 mm (1/4 inch) below sight line.

B. Locate and secure glazing pane using glazers' clips.

C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.9 REPLACEMENT AND CLEANING

A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by Resident Engineer.

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.

3.10 PROTECTION

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

3.11 GLAZING SCHEDULE

A. Fire Resistant Glass:
   1. Install clear wire glass in interior fire rated or labeled doors and windows.

B. Tempered Glass:
   1. Install in full and half glazed doors unless indicated otherwise.
   2. Install in windows, and door sidelights adjacent to doors unless otherwise indicated.
   3. Use clear tempered glass on interior side lights and doors, unless otherwise indicated or specified.
   4. Use insulating glass, SEU Low-E tempered and clear, on exterior doors and side-lights.

C. Tempered clear glass with Red Screen
   1. Install where indicated on window schedule

D. Insulating Glass, SEU Low-E and Clear
   1. Install SEU Low E clear glass in interior pane of dual glazed windows .
   2. Install where indicated on window schedule

E. Insulating glass, SEU Low-E obscure glazing assembly (laminated)
   1. Install SEU Low E obscure glazing on interior pane of dual glazed windows.
   2. Install where indicated on window schedule.

F. Tempered Frosted Glass
   1. Install where indicated on window schedule

G. Laminated Glass: Install as specified in doors, observation windows and interior pane of dual glazed windows where indicated.

H. Pattern Glass (obscure):
   Install in interior pane of dual glazed windows where indicated.

END OF SECTION

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.

1.3 SUBMITTALS

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

B. Shop Drawings:

C. Each type, showing material, finish, size of members, method of assembly, and installation and anchorage details.

D. Manufacturer's Literature and Data:

E. 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 – November 2007

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

A167-99(R2004)	Stainless and Heat-Resisting Chromium - Nickel Steel Plate, Sheet, and Strip
A1008/A1008M REV A-07	Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability
B209/B209M-07	Aluminum and Aluminum Alloy, Sheet and Plate
B221-06	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 500-505 (1988) Metal Finishes Manual

E. National Fire Protection Association (NFPA):
90A-02 Installation of Air Conditioning and Ventilating Systems

F. American Architectural Manufacturers Association (AAMA):
605-98 High Performance Organic Coatings on Architectural Extrusions and Panels

G. Air Movement and Control Association, Inc. (AMCA):

500-L-99 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 50 percent free area and shall pass 400 (fpm) free area velocity at a pressure drop not exceeding 0.1 inch water gage and carry not more than 0.06kg of water per m² 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, sills 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 CLOSURE ANGLES AND CLOSURE PLATES

A. Fabricate from 2 mm (0.074-inch) thick stainless steel or aluminum.

B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.

C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as specified.

2.4 WIRE GUARDS

A. Provide wire guards on outside of all exterior louvers.

B. Fabricate frames from 2 mm (0.081-inch) thick extruded or sheet aluminum designed to retain wire mesh.

C. Wire mesh shall be woven from not less than in 13 mm (1/2-inch) square mesh.

D. Miter corners and join by concealed corner clips or locks extending about 57 mm (2-1/4 inches) into rails and stiles. Equip wire guards over four feet in height with a mid-rail constructed as specified for frame components.

E. Fasten frames to outside of louvers with aluminum or stainless steel devices designed to allow removal and replacement without damage to the wire guard or the louver.

2.5 EXTERIOR DOOR LOUVERS

A. Fabricate of 1.6 mm (0.063-inch) thick extruded aluminum or 18 ga steel in steel doors. 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.

2.6 INTERIOR DOOR LOUVERS

A. Fabricate louvers for interior doors and partitions of 1.6 mm (0.063-inch) thick extruded aluminum. or 18ga steel in steel doors.

B. Make louvers sight-proof type with stationary blades, except where light-proof louvers are required.

C. Lightproof louvers shall have stationary blades and be designed to exclude passage of light but permit free ventilation.

2.7 WALL VENTS

A. Fabricate exterior wall vents from either 4.7 mm (0.187-inch) thick aluminum plate of 6 mm (1/4-inch) thick cast iron, perforated in diamond lattice pattern, with not over 19 mm (3/4-inch) openings.

B. Vents shall have aluminum screen frame with aluminum alloy insect screening mounted on back of vent by means of 19 mm x 5 mm (3/4-inch by 3/16-inch) top and bottom bars screwed to grille.

C. Vent Frames In Masonry: Fabricate of 45 mm x 30 mm x 5 mm (1-3/4 inch by 1-1/4 inch by 3/16-inch) steel angles bolted with 6 mm (1/4-inch) diameter expansion bolts at jambs.

2.8 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 in cavity walls or where shown .

2.9 FINISH

A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505

B. Aluminum Louvers & Air Intake Vents :
   1. Anodized finish

a. Mill finish, as fabricated.

C. Aluminum Wall Vents : Sand blasted satin finish.

D. Stainless Steel: Mechanical finish No. 4 in accordance with NAAMM Metal Finishes Manual.

E. Sheet Steel: Baked-on or oven dried shop prime coat.
   1. 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.

2.10 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 may be used, except for removal items and where members would be deformed or substrate damaged by their use.

D. 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

END OF SECTION

SECTION 09 06 00
SCHEDULE FOR FINISHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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

A. 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

A. 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. MASTER PAINTING INSTITUTE: (MPI)
2001 Architectural Painting Specification Manual

PART 2 - PRODUCTS

2.1 COLOR SLIDES

A. Size 24 x 35 mm.

B. Labeled for:

1. Building name and Number.
2. Room Name and Number.

2.2 DIVISION 03 – CONCRETE

A. SECTION 03 30 00, CAST IN PLACE CONCRETE & SECTION 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE

Surface	Finish Description
All CIP	See Specification

B. SECTION 05 50 00, METAL FABRICATION

Item	Finish
Channel Door Frames	See Door Schedule
Edge Guards Angles for Opening in Slabs	Galvanized
Steel Grating and Frames	Galvanized
Aluminum Plate Door Sill	Anodized
Steel Ladders	Galvanized
Aluminum Ladders	Anodized
Steel Ladder Rungs	Galvanized
Steel Pipe Railings and Gates (not on Steel Stairs)	Galvanized

2.3 DIVISION 07 - THERMAL AND MOISTURE PROTECTION

A. BUILT-UP BITUMINOUS ROOFING (07 51 00)

Pavers	Size	Material	Color	Manufacturer	Mfg. Color Name/No.
		See Spec			Submit Color Options

B. SECTION 07 60 00, FLASHING AND SHEET METAL

Item	Material	Finish

Copings	Aluminum or GSM	Anodized or Painted

C. SECTION 07 71 00 , ROOF SPECIALITIES

Item	Material	Finish	Manufacturer	Manufacturer/Color Name/Number.
Equipment Support	Galv. Steel	Paint to match exterior wall color		See Spec for painting GSM
Copings	Aluminum or GSM	Anodized or Paint		PT-7
Fascia Systems (Canopy)	Extruded Aluminum	Anodized		Color Match/Submit Colors

D. SECTION 07 92 00, JOINT SEALANTS

Location	Color	Manufacturer	Manufacturer Color
Exterior Building Joints	Match Exterior Wall		
Metal Reglets & Flashing	Match Exterior Wall		
Interior Caulking	Match Wall Color		

2.4 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 to door	
Component	Color of Paint Type and Gloss
Door	See Door Schedule
Frame	See Door Schedule
Window frame	See Window Schedule

B. SECTION 08 31 13, ACCESS DOORS AND FRAMES

Material	Finish/Color
Steel	Paint – Match Ceiling Color (see spec)
Stainless steel	Satin Brushed (no. 4)

C. SECTION 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

Material	Finish	Manufacturer	Manufacturer Color Name/No.
Aluminum	Anodized		
Glass	See Window Schedule		

D. SECTION 08 51 13, ALUMINUM WINDOWS

Type	Finish	Glazing	Manufacturer	Mfg. Color Name/No.
Fixed	Anodized	See Window Schedule	See Spec.	

E. WINDOW SILLS

Room No. and Name	Material	Finish
See Plan	Aluminum (With Windows)	Paint to match wall

F. SECTION 08 71 00, BUILDERS HARDWARE

Item	Material	Finish
Hinges	See spec	
Door Closers	See spec	
Floor Pivot Sets	See spec	
Closer/ Holder	See spec	
Floor Stops	See spec	
Door Holders	See spec	
Lock/ Latches	See spec	
Key Cabinet	Steel	Mfr prefinished – Architect to select color

Armor Plates	Stainless Steel	Satin Brushed
Kick Mop Plates	Stainless Steel	Satin Brushed
Exit Device	See spec	
Flush Bolts	See spec	
Door Pulls	See spec	
Push Plates	See spec	
Combination Push Pull Plate	See spec	
Coordinators	See spec	
Light Proof Seals	See spec	
Weather Strip	See spec	
Threshold	Aluminum	Mill FInish

G. SECTION 08 80 00, GLAZING

Glazing Type	Manufacturer	Mfg. Color Name/No.
Insulating Glass, SEU Low-E & Clear	See spec	
Tempered Frosted Glass	See spec	
Insulating Glass, SEU Low-E Tempered & Clear	See spec	
Insulating Glass, SEU Low-E Obscure	See spec	

2.5 DIVISION 09 - FINISHES

A. SECTION 09 24 00, PORTLAND CEMENT PLASTERING

Finish code	Integral	Color	Manufacturer	Mfg. Color Name/No.

Building Exterior	Yes	Match Adjacent Building	See spec	

B. SECTION 09 30 13, CERAMIC TILING

2. SECTION 09 30 13, CERAMIC TILING		
Finish Code	Manufacturer	Mfg. Color Name/No
CT-1	Crossville	B210, Seabreeze, Unpolished
CT-2	Crossville	B210, Seabreeze, Polished
CT-3	Crossville	AV182 Foothills

10. SECTION 09 30 13, MARBLE THRESHOLDS		
Marble Type	Manufacturer	Mfg. Color Name/No.
		Architect to select

C. SECTION 09 51 00, ACOUSTICAL CEILINGS

Finish Code	Component	Color Pattern	Manufacturer	Mfg Name/No.
	Exposed Suspension System			
ACT	Acoustic Tile	White	Armstrong	Ultima
WCT	Washable Acoustic Tile	White	Armstrong	Optima Health Zone

D. SECTION 09 65 19, RESILIENT TILE FLOORING (COLD WELDED SEAMS – SEE FINISH SCHEDULE)

Finish Code	Size	Material/Component	Manufacturer	Mfg Name/No.
RT-1	39.53” x 39.53”	Resilient Tile	NORA	Norament Grano
RT-2	39.53” x 39.53”	Resilient Tile	NORA	Norament Grano

E. SECTION 09 65 13, RESILIENT BASE

Finish Code	Item	Height	Manufacturer	Mfg Name/No.
RB	Rubber Base (RB)	4” U.O.N.	Johnsonite	55 Silver Gray WG

F. SECTION 09 68 13.01, CARPET MODULES (CPT)

Finish Code	Size	Pattern direction	Manufacturer	Mfg. Color Name/No.
CPT	24” x 24”	Catalyst Tile	Shaw Contract Group	Dapple #64761

G. SECTION 09 67 23.30, EPOXY RESINOUS FLOORING (EPY)

Finish code	Manufacturer	Mfg. Color Name/No.
EPY	Stonclad GR	See Finish Schedule

H. SECTION 09 67 23.60, URETHANE RESINOUS FLOORING (UR)

Finish code	Manufacturer	Mfg. Color Name/No.
UR	Stonclad UR	See Finish Schedule – Custom Color

I. SECTION 09 96 59, HIGH-BUILD GLAZED COATING (HBES)

Finish code	Manufacturer	Mfg. Color Name/No.
FR-HBES	See Spec	Color Match PT-1
NR-HBES	See Spec	Color Match PT-1

J. 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	Latex Acrylic	Benjamin Moore	OC-6 Feather Down
PT-2	Epoxy	See Spec	
PT-3	Latex Acrylic	Benjamin Moore	HC-146 Wedgewood Gray
PT-4	Latex Acrylic	Benjamin Moore	HC-143 Wythe Blue
PT-5	Latex Acrylic	Benjamin Moore	HC-136 Waterbury Green
PT-6	Match Façade Paint	Of Existing Bldg 6	
PT-7	Match Façade Paint	Of Existing Bldg 6	
PT-8	Match Terracotta Panel	Of Existing Bldg 6	
PT-9			Color Match PT-1

2.6 DIVISION 10 - SPECIALTIES

A. SECTION 08 90 00, LOUVERS AND WALL VENTS (SEE EXTERIOR ELEVATIONS)

Item	Material	Finish	Manufacturer	Mfg. Color Name/No.
	Aluminum	Anodized		

B. SECTION 10 26 00, WALL GUARDS AND CORNER GUARDS

Item	Material	Manufacturer	Mfg. Color Name/No.
Corner Guards	Stainless Steel		Satin Brushed
Wall Guard	Aluminum		

C. SECTION 10 28 00 , MISCELLANEOUS SPECIALITIES

Room No. and Name	Item	Finish	Manufacturer	Mfg. Color Name/No.
	Mop racks		VA Standard	Confirm w/ COTR

D. SECTION 10 44 13, FIRE EXTNGUISHER CABINETS

Component	Material	Finish
FEC	See Spec	

E. SECTION 10 28 00, TOILET AND BATH ACCESSORIES

Item	Material	Manufacturer	Mfg. Color Name/No.
See Plans & Elevations	VA Standard	VA Standard	Confirm with COTR

2.7 DIVISION 13 - SPECIAL CONSTRUCTION

A. SECTION 14 21 00, ELECTRIC TRACTION ELEVATORS (SEE PLANS & SPECIFICATION)

Elevator	Component	Material	Finish	Color
Clean Elevator	Hoistway Entrance	See Spec		
	Hoistway Doors	See Spec		
	Corridor Position Indicator and Call Buttons	See Spec		
	Car Canopy	See Spec		
	Car Wainscot	See Spec		

	Panels Above Wainscot	See Spec		
	Car Floor	See Spec		
	Car Operating Panel	See Spec		
Soiled Elevator	Hoistway Entrance	See Spec		
	Hoistway Doors	See Spec		
	Corridor Position Indicator and Call Buttons	See Spec		
	Car Canopy	See Spec		
	Car Wainscot	See Spec		
	Panels Above Wainscot	See Spec		
	Car Floor	See Spec		
	Car Operating Panel	See Spec		

2.8 DIVISION 22 - PLUMBING

A. SECTION 22 40 00, PLUMBING FIXTURES AND TRIM (SEE PLUMBING SPECS & DRAWINGS)

Item	Color
Water Closet	
Urinal	
Lavatories	
Service Sink Corner	
Service Sink	

2.9 DIVISON 16 - ELECTRICAL

A. SECTION 26 51 00, BUILDING LIGHTING INTERIOR (SEE ELECTRICAL SPECS & DRAWINGS)

Fixture Type	Exterior Finish	Color

PART 3 - EXECUTION

3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS (SEE DRAWINGS)

3.2 ROOM FINISH SCHEDULE (SEE DRAWINGS)

END OF SECTION

SECTION 09 21 27
EXTERIOR STUD WALL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Exterior Stud Wall System, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 DESIGN RESPONSIBILITY

A. Provide engineering design performed and sealed by registered Engineer, licensed to practice Structural Engineering in the State of California.

B. Design Criteria:
1. Design Exterior Stud Wall System to satisfy requirements of applicable building codes as locally amended, but not less than loads shown in contract documents.
   a. Design Exterior Soffits similarly.
   b. Include all superimposed loads.
2. Limit lateral deflection of stud wall system due to wind or earthquake as follows:

MAXIMUM ALLOWABLE DEFLECTION	
Exterior Finish Material	**Deflection Limit**
Marble, Granite and other Stone Veneers	L/720
Brick and Concrete Masonry Veneers	L/600
Portland Cement Plaster (Stucco)	L/360
Manufactured Stone Veneer, Adhered Stone Veneer, Thin Brick, Tile and similar Mortar-Set finishes.	L/360
Metal Panels, Curtainwalls, and other flexible wall finishes.	L/240

3. Select stud gauge and spacing as required to limit deflection due to applied loads.
   a. Utilize strength properties of metal stud only. Disregard contribution of facings such as Gypsum Wall Board and Gypsum Sheathing, which lose strength when wet.
4. Size and define headers reinforcing members around openings.
5. Develop details defining method of fastening throughout system.
6. Review and professionally seal submittals.

C. Framing System for Exterior Soffits – Additional Criteria:
1. In addition to gravity loads, design framing system to resist wind uplift.

1.3 SUBMITTALS

A. Shop Drawings:
1. Complete Building Elevations defining framing member sizes, locations, and connection details.
   a. Show openings, edges and support conditions that have been field verified with respect to location.

b. Show openings, edges and support conditions that have coordinated with respect to physical requirements of items to be installed in or on exterior wall system.

2. Details and isometrics at windows showing layouts of Air Barrier Flashings and sequence of installation.

B. Project information:
1. Catalog data indicating cross sectional properties.
2. Structural calculations.
3. Certification Exterior Stud Wall System has been designed, to satisfy specified design criteria, sealed by registered Engineer, licensed to practice Structural Engineering in State of California.
4. Manufacturer name of sheathing.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Exterior metal studs:
1. Base:
   a. Dietrich Industries (Worthington Industries).
2. Optional:
   a. Clarkwestern Building Systems.
   b. California Expanded Metal Products Co. (CEMCO).
   c. Allied Studco.
   d. Custom Stud Inc.
   e. Marino\WARE.
   f. MRI Steel Framing LLC.
   g. The Steel Network.
   h. Telling Industries.
   i. Or Approved Equal

B. Sheathing:
1. Base:
   a. Georgia Pacific.
2. Optional:
   a. National Gypsum Company.
   b. USG.
   c. CertainTeed.
   d. Temple-Inland.
   e. Or Approved Equal

C. Seam Sealant, for sheathing:
1. Base:
   a. Dow Corning.
2. Optional:
   a. Pecora.
   b. Tremco.
   c. Or Approved Equal
   d. Other manufacturers as recommended by maker of Sheathing.

D. Galvanizing repair coating:
1. Base:
   a. Tnemec.
2. Optional:

a. ZRC Worldwide.
b. Or Approved Equal.

2.2 EXTERIOR METAL STUDS

A. Exterior Studs:
1. Galvanized steel studs, runner channels and track, bracing, and accessories, ASTM-A653/A653M minimum G60 galvanized.
2. Select members in accordance with Design Criteria.
3. Stud depth: As indicated on Drawings.
4. Span: As indicated on Drawings.
5. Stud spacing: 16 IN OC, use closer spacing, minimum 12 IN OC, as needed to satisfy load deflection criteria.
6. Stud Gauge: As determined for loads and deflection criteria.
7. Minimum thickness for Studs, Runners and Tracks: 43 mils (18 GA); use heavier thickness as needed to satisfy loading and deflection criteria.
8. Minimum flange on Deep-Leg runners: 2 IN.
9. Runner fasteners: Power driven fasteners to withstand minimum 190 LB shear and bearing.
10. Headers: C-shapes used to form header beams, of web depths required and with stiffened flanges. Gauges: As determined by engineering calculations for specific openings.

2.3 EXTERIOR SHEATHING (GYPSUM)

A. Exterior Gypsum Sheathing:
1. General Description: Water-resistant, mold-resistant suitable for long term weather exposure during construction.
2. Comply with ASTM-C1177.
3. Minimum Mold Resistance: 10 rating per ASTM-D3273.
4. Minimum Thickness: 1/2 IN thick.
   a. Upgrade to 5/8 IN, thick Type X product version where fire rated Exterior walls are indicated.
   b. Soffit boards: Upgrade to appropriate non-sag product where sheathing is used horizontally as in soffits.
5. Base Products:
   a. Description: Water-resistant treated gypsum core sheathing board with glass mat facers.
   b. Approved products meeting this criteria:
      1) Dens-Glass Gold Exterior Sheathing by Georgia Pacific.
      2) e^2XP Extended Exposure Sheathing by National Gypsum.
      3) Securock Glass-Mat Sheathing by USG.
6. Optional Products:
   a. Description: Facer-less, water-resistant treated gypsum core sheathing board with embossed drainage pattern on back.
   b. Approved products meeting this criteria:
      1) GlasRoc Sheathing by Certainteed.

B. Seam Sealant and Fastener Head Sealant:
1. Coordinate sealant for compatibility with selected air or vapor barrier systems and sheathing.

C. Finish System for Exterior Soffits and Ceiling Boards:
1. General:
   a. System designed for compatibility with proposed brand of Exterior Ceiling/Soffit Board; The following is based on substrate using Dens-Glass Gold Exterior Sheathing by Georgia Pacific.
2. Finish System:

a. Reinforcing mesh and base coat.
b. Base coat.
c. Finish coat.
d. Base Product: ToughRock setting compound, smooth finish.

D. Fasteners: Sized as required.
1. Screws: Cadmium plated or stainless.
2. Clips: Galvanized or zinc.
3. Thread count as appropriate for stud materials specified.

E. Sheathing accessories: Galvanized, or zinc.

2.4 AIR AND VAPOR BARRIER, SELF-ADHERED TYPE

A. See Section 07 27 16.01

2.5 OTHER MATERIALS

A. Galvanizing repair coating: Tnemec 90-93 or ZRC Worldwide, Galvilite.

B. Gypsum wallboard, interior: Specified in Section 09 29 00.

C. Insulation and Vapor Retarder: Specified in Section 07 21 00.01.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrate for suitability to accept work.

B. Start of work constitutes acceptance of substrate and responsibility for performance.

3.2 ERECTION – STUDS AND SHEATHING

A. Install cold-formed framing in accordance with requirements of ASTM-C1007 and with applicable sections of the AISI Standard for Cold-Formed Steel Framing General Provisions.

B. Comply with manufacturer's instructions.

C. Openings: Install header, jamb, and sill framing system per approved engineering documents

D. Expansion Joints at Portland Cement Plaster:
1. Utilize double studs, spaced 3/8 IN apart, where expansion joints are indicated.
2. Sheathing shall not be continuous across expansion joints.

E. Studs and runners:
1. Align outside deep leg runner track accurately according to exterior wall layout.
2. Fasten 12 IN OC, or as needed to satisfy design criteria.
3. Position studs vertically in inside deep leg runners at required spacing.
4. Install minimum of 2 studs each side of openings; use more if required to meet loadings.
5. Anchorage:
a. Top:
1) Allow 3/4 IN clearance between top of inside deep leg runner and outside deep leg runner.
2) Do not fasten inside deep leg runner to outside deep leg runner.
3) Fasten studs to inside deep leg runner.
b. Bottom:
1) Anchor each stud at bottom to runners with two, 3/8 IN minimum, type S-12 pan head screws.

6. Where stud design is outside edge of floor slab, provide galvanized connectors designed for loading requirements and allow individual floor movement without affecting integrity of stud system.
7. Shop weld assemblies as required to meet design requirements.
8. Touch-up burned off or abraded galvanizing with galvanizing repair coating.

F. Metal Wall Backing: Specified in Section 09 22 16.
1. Coordinate installation of metal wall backing used to support wall-supported items with installation of exterior stud wall system.
2. See Section 09 22 16 for items requiring metal wall backing.

G. Exterior Sheathing:
1. Edges of sheathing panels to land at stud centers.
2. Screw to exterior of each stud as recommended by manufacturer.
3. Butt sheathing boards together tightly:
   a. Maximum gap between boards: 1/8 IN.
   b. Seal seams and fastener heads with sealant per Method 1 as described by Georgia Pacific.
4. Sheathing at roof-side of parapet walls:
   a. Apply sheathing on roof side of stud framed parapet walls.

H. Exterior Ceilings and Soffits:
1. Control Joints;
   a. Locate control joints in a manner that subdivides ceilings/soffits as indicated, and within the following limits: Subdivide so that no area exceeds 900 FT^2, and no area has a length which exceeds 30 FT.
   b. Locate control joints at transitions between areas of different shapes.
2. Finish System:
   a. Tape joints with glass mesh tape.
   b. Fill screw heads.
   c. Apply skim coat over entire surface.
3. Paint: Specified in Section 09 91 13 / Exterior Painting.

3.3 INSTALLATION OF AIR BARRIER

A. See Division 07.

3.4 PROTECTION

A. Protect erected wall and openings with temporary covers until finish, roofing, flashing, and windows are installed.

3.5 REPAIRS

A. Repair portions of sheathing which is damaged by rain, wind, or prolonged exposure.

B. Repair portions of Air Retarder which are damaged by wind or due to prolonged exposure.
1. Damage shall include rips, tears, loss of adhesion of seam tape, and elongation of membrane at fastener penetrations.

END OF SECTION

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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

A. In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

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

B. American Society For Testing And Materials (ASTM)

A123-09	Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
A653/A653M-09	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
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
C636-06	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
C645-09	Non-Structural Steel Framing Members
C754-09	Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
C841-03(R2008)	Installation of Interior Lathing and Furring
C954-07	Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
C1002-07	Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
E580-09	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

A. Galvanize steel studs, runners (track), rigid (hat section) furring channels, "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.

2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)

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

B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

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

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

3.2 INSTALLING STUDS

A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.

B. Space studs not more than 610 mm (24 inches) on center.

C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.

D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.

E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions and insulated exterior wall furring.

F. Openings:
   1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
   2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
   3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.

G. Fastening Studs:
   1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
   2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

H. Chase Wall Partitions:
   1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
   2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

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

J. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. Wall furring-Stud System:
   1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.

2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

C. Direct attachment to masonry or concrete; rigid channels 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.

3.5 INSTALLING SHAFT WALL SYSTEM

A. Conform to UL Design No. U438 for two-hour fire rating. Provide one hour fire rating Shaft wall at elevator's shafts & duct shafts.

B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 600 mm (24 inches) on center.

C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.

D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.

E. Suitably frame all openings to maintain structural support for wall:
1. Provide necessary liner fillers and shims to conform to label frame requirements.
2. Frame openings cut within a liner panel with E studs around perimeter.
3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

F. Elevator Shafts:
1. Frame elevator door frames with 0.87 mm (0.0341-inch) thick J strut or J stud jambs having 75 mm (three-inch) long legs on the shaft side.
2. Protrusions including fasteners other than flange of shaft wall framing system or offsets from vertical alignments more than 3 mm (1/8-inch) are not permitted unless shown.

3. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

3.6 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS

A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.
   1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
   2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.

B. New exposed concrete slabs:
   1. Use metal inserts required for attachment and support of hangers or hanger wires with tied wire loops for embedding in concrete.
   2. Furnish for installation under Division 3, CONCRETE.
   3. Suspended ceilings under concrete rib construction shall have runner channels at right angles to ribs and be supported from ribs with hangers at ends and at 1200 mm (48-inch) maximum intervals along channels. Stagger hangers at alternate channels.

C. Concrete slabs on steel decking composite construction:
   1. Use pull down tabs when available.
   2. Use power activated fasteners when direct attachment to structural framing can not be accomplished.

D. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.

E. Steel decking without concrete topping:
   1. Do not fasten to steel decking 0.76 mm (0.0299-inch) or thinner.
   2. Toggle bolt to decking 0.9 mm (0.0359-inch) or thicker only where anchorage to steel framing is not possible.

F. Installing suspended ceiling system for gypsum board (ASTM C635 Option):
   1. Install only for ceilings to receive screw attached gypsum board.
   2. Install in accordance with ASTM C636.
      a. Install main runners spaced 1200 mm (48 inches) on center.
      b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
      c. Install wall track channel at perimeter.

G. Installing Ceiling Bracing System:
   1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
   2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.
   3. Brace suspended ceiling or soffit framing in seismic areas in accordance with ASTM E580.

3.7 TOLERANCES

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

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

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

END OF SECTION

SECTION 09 22 36.01
METAL LATH

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Metal Lath, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Wherever a fire resistance classification is indicated or scheduled; provide materials, accessories and application procedures which have been listed by U/L or tested in accordance with ASTM-E119 for type of construction.

B. Lathing standards:
   1. Applicable requirements of governing codes.
   2. Applicable requirements of ASTM-C1063 for installation .
   3. Applicable requirements of ASTM-C841 for installation.
   4. Metal Lath Association recommendations.

C. Materials standards:
   1. Carbon Steel: ASTM-A1008.
   2. Expanded Metal Lath: ASTM-C847.
   3. Wire: ASTM-A641 with Class I zinc-coated (galvanized) soft tempered.
   4. Galvanized coating of steel items: ASTM-A353 .

1.3 SUBMITTALS

A. Product Data:
   1. Items to be used, including:
      a. Control and Expansion Joints, screeds, reveals, vents, flashing and other pieces.
      b. Kraft Paper and self-adhering flashing.
      c. 2-piece flashing.

B. Shop Drawings:
   1. Layout Drawings of exterior walls to receive PC Plaster, showing locations of expansion/control joints.

C. Samples:
   1. 12 IN 12 IN samples of all linear accessories to be used.
   2. 8x10 IN samples of Lath and Kraft Paper.

D. Project Information:
   1. Manufacturer of listed products.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Kraft Paper and Self-adhering Flashing:

1. Base:
    a. Fortifiber.
2. Or Approved Equal

B. Building Paper: See Air Barrier as specified in Section 09 21 27.

C. Furring, Lathing and sheet metal lathing accessories:
1. Base:
    a. Dietrich Industries.
2. Optional:
    a. Alabama Metal Industries Corp. (AMICO).
    b. California Expanded Metal Products Co. (CEMCO).
    c. Niles Building Products.
    d. Or Approved Equal

D. Sheet Metal Lathing Accessories:
1. Base:
    a. Dietrich Industries.
2. Optional:
    a. Alabama Metal Industries Corp. (AMICO).
    b. California Expanded Metal Products Co. (CEMCO).
    c. Niles Building Products.
    d. Or Approved Equal

E. Extruded Aluminum Reveals and Moulding Accessories:
1. Base:
    a. Fry Reglet.
2. Optional:
    a. Pittcon Industries.
    b. Or Approved Equal

F. 2-Piece wall flashing:
1. Base:
    a. Fry Reglet.
2. Or Approved Equal

2.2 MATERIALS

A. Kraft Building Paper (Vapor Permeable):
1. Asphalt saturated, grade D Kraft breather paper.
2. Federal Specification: UU-B-790a Type 1, Grade D, Style 2.
3. Minimum Water Resistance rating: 60 Minutes per ASTM-D779.
4. Minimum Permeance (per ASTM-E96): 35 Perm (US).
5. Base Product: Fortifiber, 60 Minute Super Jumbo Tex.
6. Install in 2 layers.
    a. 1 layer of Kraft paper may be pre-attached to Lath at contractor's option.

B. Self-adhering Flashing for Kraft Building Paper:
1. Self-adhesive, self-sealing, rubberized asphalt laminated to HDPE film.
2. Compatible with building paper and substrates specified.
3. Minimum Permeance (per ASTM-E96): 0.08 Perm (US).
4. Minimum Water Resistance rating: >200 Hours per ASTM-D779.
5. Federal Specification: UU-B-790a Type 1, Grade A, Style 4.
6. Base Product: Fortifiber FortiFlash 25.

C. Primer for Self-adhering Flashing:
1. As recommended by manufacturer for substrate conditions.

D. Air Barrier (for use with Portland Cement Plaster)
   1. Spunbond polyolefin, non-woven, non-perforated
   2. Performance:
      a. ASTM-E1677 Type I Air Barrier:
         1) Air Leakage at 25 mph wind pressure: Less than 0.6 CFM/SQ-FT.
      b. Water Vapor Transmission: 50 perms in accordance with ASTM-E96, Method B.
      c. Water Penetration Resistance of 210 cm of hydrostatic head in accord with AATCC-127.
      d. Flame spread and smoke developed per ASTM-E84: Class A
   3. Base Product: "Tyvek StuccoWrap" by Dupont.

E. Furring and Lathing Materials:
   1. Furring, lathing, and hanger wires:
      a. Exterior Areas: G60 galvanized steel or zinc alloy.
      b. Interior: G60 galvanized steel.
   2. Kraft paper-faced lath is acceptable where the following conditions are met:
      a. Performance quality of the facing must meet or exceed criteria listed for Moisture resisting membrane.
      b. Offset between lath and facing must enable proper shingle-lap installation.
      c. Facing may only be used in lieu of one of two membrane layers required.
      d. Second membrane layer must be independent of lath.

F. Metal Lath (diamond mesh):
   1. Comply with ASTM-C847.
   2. Self-furring, diamond mesh lath.
      a. Self-furring design comprised of dimples or crimps designed to hold the lath 1/4 to 3/8 IN away from solid base.
      b. Rib lath shall not be permitted.
   3. Minimum Weight:
      a. Exterior Plaster: 1.3 2.5 *3.4* LBS/YD^2.
      b. Interior Plaster: 2.5 LBS/YD^2.
   4. Base Product: Self-furring Junior Diamond Lath by Dietrich.

G. High Rib Lath:
   1. For PC Plaster Ceilings in Correctional Facilities.
   2. Thickness: 3/8 IN.
   3. Minimum Weight: 3.4 LBS/YD^2.
   4. Base Product: "3/8 High Rib Lath" by Dietrich.

H. U-channels:
   1. Exterior Use:
      a. Cold-formed, C-shaped members.
      b. Minimum Depth/Height: 6 IN or deeper as indicated or required for load.
      c. Metal Thickness: 16 GA or heavier as required for load.Select member sizes and attachment mechanisms to resist wind forces, positive and negative.
      d. Base Product: C-Studs by Dietrich.
   2. Interior Use:
      a. Cold-formed, U-shaped members.
      b. Height: 3/4 IN or 1-1/2 IN, as indicated or required for load.
      c. Metal Thickness: 16 GA.
      d. Base Product: CHN U-Channel by Dietrich.

I. Hat-channels:
   1. General:
      a. Cold-formed, hat-shaped members.

b. Height: 7/8 IN or 1-1/2 IN, as indicated or required for load.
2. Exterior Plaster:
a. Metal Thickness: 16 GA or 18 GA, as required for load.
b. Base Product: FMC Heavy Duty Furring Channel by Dietrich.
3. Interior Plaster:
a. Metal Thickness: 16 GA or 25 GA, as required for load.
b. Base Product: FC Furring Channel by Dietrich.

J. Hanger Wire:
1. Class I zinc-coated (G60 galvanized), soft tempered wire.
2. Comply with ASTM-A641 and C1063.
3. Thickness: 8 GA.
4. Base Products: HWB8 Hanger Wire by Dietrich.

K. Tie Wire:
1. Class I zinc-coated, G60 galvanized, soft tempered wire.
2. Comply with ASTM-A641 and C1063.
3. Thickness: 18 GA.
4. Base Products: TW18 Tie Wire by Dietrich.

L. Fasteners:
1. General:
a. Corrosion-resistant, fasteners specifically suited for attachment of lathing and accessories.
b. Select fasteners with oversized heads and of a fastener type which is appropriate for substrates encountered.
2. Steel frame substrates:
a. Corrosion-resistant screws, No. 8 modified truss head.
b. Length: As necessary to penetrate through sheathing and into steel studs by at least 5/8 IN.
3. Concrete and Masonry substrates (where lathing is specified):
a. Corrosion-resistant, powder actuated fasteners.
b. Length: As necessary to penetrate through sheathing and into steel studs by at least 5/8 IN.

2.3 SHEET METAL ACCESSORIES

A. General:
1. Complying with ASTM-C1063.
2. Materials:
a. Exterior Areas: Zinc alloy.
b. Interior Areas, typical: G-60 galvanized steel or zinc alloy.
c. Interior Wet Areas, high-humidity: Showers, natatoriums, etc.:
1) Zinc alloy.

B. Foundation Weep Screed:
1. Solid, protruding V-hem screed and solid vertical wall flange.
a. Weep holes through hem.
b. Fasten top flange to substrate only.
2. Depth: As required for plaster thickness.
3. Minimum Height: 3-1/2 IN.
4. Minimum Thickness: 26 GA.
5. Base Product: No.7 Foundation Weep Screed by Dietrich.

C. Casing Bead, Plaster Stop, J-Bead:
1. Solid metal, J-shaped edge with expanded metal flange.

a. 1/4 IN return on face edge.
2. Flange Size: 2-3/4 IN flanges.
3. Depth: As required for plaster thickness.
4. Base Product: No.66 Casing Bead by Dietrich.

D. Outside Corner Bead:
1. Straight:
a. Rigid-nosed corner bead with expanded metal flanges.
b. Size: 2-7/8 IN flanges.
c. Base Product: 1-A Expanded Corner Bead by Dietrich.

E. Inside Corner Reinforcing Mesh:
1. Strips of expanded metal reinforcing mesh with flanges at appropriate angles.
2. Size: 3 IN flanges.
3. Base Product: Cornertite by Dietrich.
4. Where internal corners must also function as a control joint, see following paragraph.

F. Control Joints (CJ):
1. Double J Shape:
a. Solid metal center section with opposing J-shaped bends and expanded metal flanges.
1) Rolled outer edges of reveal flanges to facilitate keying of plaster.
b. Flanges: 1-1/4 IN.
c. Depth: As required for plaster thickness.
d. Reveal Width: 5/16 IN.
e. Base Product: Double-J Control Joint by Dietrich.
2. Control Joints at Internal Corners:
a. Solid metal center section with M-profile bend and expanded metal flanges.
1) Use where internal corners are function as control joints.
b. Size: 1-1/4 IN flanges.
c. Depth: As required for plaster thickness.
d. Base Product: No.30 Corner Master by Dietrich.

G. Expansion Joints (EJ):
1. Two piece, slip joint.
2. Size: 1 IN flanges.
3. Depth: As required for plaster thickness.
4. Reveal width: 1/2 IN
5. Base Product: No.40 Expansion Joint by Dietrich.

2.4 EXTRUDED ALUMINUM ACCESSORIES

A. General:
1. Material: 6063 T5 extruded aluminum.
a. Thickness: 0.0625 IN thick.
b. Anodized Finish:
1) Clear.
2. Shapes: As listed below.
3. Depth: As required for plaster thickness.

B. Drip Screed:
1. Reveal Width: 22 mm 7/8 IN.
2. Vented.
3. Base Product: Drip Screed, Stucco Drip Screed, or Thin Stucco Drip Screed by Fry Reglet.

C. Soffit Molding:
1. Reveal Width: 50 mm 2 IN.

2. Vented.
3. Base Product: Soffit Molding by Fry Reglet.

D. Reveal Modling, Square bottom:
1. Reveal Width: 19mm ¾ IN.
2. Base Product: Channel Screed by Fry Reglet.

E. F-moulding:
1. Reveal Width: 19mm ¾ IN.
2. Base Product: F-Reveal Molding Screed by Fry Reglet.

F. J-Channel width: ¾ in.

G. J-Modling width: ¾ in.

H. Channel screed width: ¾ in.

I. Vertical molding width: ¾ in.

J. General:
1. 2-piece system consisting of a fixed, built-in receiver and a snap-in counterflashing flange.
2. Include factory-mitered corner units.
3. 24 GA galvanized steel.
4. Finish: Factory applied Kynar 500.
5. Color: As selected by Architect.
6. Base Product: Fry Springlok Flashing System.

K. Receiver:
1. ST or STX configuration which is indicated or most appropriate for conditions.
2. Install prior to beginning plaster.
3. Install at height indicated, or as recommended by manufacturer.
4. Surface applied items not acceptable.

L. Counterflashing:
1. Minimum Height: 5 IN.

M. Retainer:
1. Install continuous vinyl retainer to seal and complete joint.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify.
1. Verify that substrates and membranes specified are clean, sound, dry, weathertight and suitable to accept installation

B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - FURRING AND SUSPENSION SYSTEMS

A. Provide complete system including hangers, ties and runners, to provide support for plaster bases, per ASTM requirements.

B. Where expansion joints are indicated, provide separate supports on each side of joint.

C. Do not bridge expansion joints with metal furring.

D. Where curved furring is required, shop fabricate to configurations required.

E. Hangers:
   1. Suspend hangers from structure per ASTM-C841.
   2. Where anchorage, spacing or location does not provide for acceptable support, provide additional carrying components.
   3. Provide hanger inserts to concrete installer, in time to avoid delay in progress of work.
   4. Advise concrete installer of specific requirements for placement of inserts.
   5. Locate hangers plumb in relation to main runners.
      a. Avoid contact with pipe and duct insulation.
      b. Do not pass hangers through ducts.
      c. Alter spacing of hangers or splay hangers to avoid ducts and other obstructions.
      d. Do not exceed maximum allowable ceiling areas to be supported by each hanger.
      e. Offset horizontal forces of splayed hangers by counter splaying, bracing or other suitable means.
   6. Provide extra hangers to support light fixtures, diffusers, grilles, access panels and other items resting in or on ceilings.

F. Framing:
   1. Determine span and spacing as required by local building code and to resist loads anticipated.
   2. Select member sizes and gauges as appropriate for span and spacing.
   3. Provide additional ceiling framing as required to form and frame openings; coordinate with work of other trades.

3.3 INSTALLATION OF ACCESSORIES

A. Use single length beads wherever length of run does not exceed longest standard stock length available.
   1. Miter or cope at corners.
   2. Set beads with maximum tolerance of 1 in 100 from plumb or level.
   3. Shim as required and align joints with concealed splices or tie plates.

3.4 INSTALLATION – WEEP SCREEDS

A. Position so vertical flange overlaps top of foundation.

B. Position so that bottom of screed is at least 6 IN above soil line.
   1. Exception 1: Minimum 2 IN where adjacent to paved surfaces.
   2. Exception 2: As otherwise indicated.

C. Pre-flash wall with a 8 to 10 IN wide strip of self-adhering flashing before securing weep screed over it.

D. Secure weep screed to wall framing using galvanized fasteners.
   1. Maximum spacing: 8 IN OC.
   2. Do not secure to foundation.

E. Lap moisture resisting membrane and metal lath over the vertical flange of the screed.

3.5 INSTALLATION – CASING BEADS

A. General:
   1. Install in accordance with ASTM-C841.
   2. Provide casing beads at edges where plaster meets windows, doors, louvers and other terminal edges and where plaster meets dissimilar materials.
   3. Do not plaster directly to frames of windows, doors, or louvers.

a. Separate plaster using appropriate casing beads set 3/8 IN from the frame with provision to receive backer rod and sealant as specified in Section 07 92 13 and Section 07 92 16.

B. Exterior:
1. Pre-flash wall with a 8 to 10 IN wide strip of self-adhering flashing before securing casing bead over it.
2. Secure casing bead to wall framing using galvanized fasteners.
   a. Maximum Spacing: 8 IN OC.
3. Lap moisture resisting membrane and metal lath over vertical flange of casing bead.

3.6 INSTALLATION – MOISTURE RESISTING MEMBRANE

A. Self-adhering Flashing:
1. Install concealed flashings at the following locations:
   a. Perimeter of windows, louvers and other similar openings.
   b. Pipes and other penetrations thru walls.
   c. Under expansion joints.
   d. Sills.
   e. Horizontal surfaces.
   f. Tops of parapet and wall caps.
   g. Door thresholds.
   h. Where membrane ties into air barriers or other membranes specified in other Sections.

B. Moisture Resisting Membrane:
1. Install after securing weep screeds and casing beads to wall.
2. Install bottom row of membrane over the vertical flange of weep screed.
3. Install successive rolls horizontally above preceding rows.
4. Horizontal seams: 3 IN shingle lap.
5. Vertical Seams:
   a. Overlap at least 6 IN.
   b. Stagger vertical seams in successive rows.
6. Tie-in to penetrations:
      1) Maintain shingle laps and avoid conditions which would impede weeping of system.
   b. Secure membrane to substrate according to manufacturer's recommendations.
7. Install a second layer of membrane.
   a. Install as described for first layer.
8. Install lath over moisture resisting membrane as outlined below.

3.7 INSTALLATION - LATH

A. General:
1. Comply with ASTM-C1063 requirements for installation of lath.
2. Provide intermediate metal furring supports where required.

B. Layout and lapping:
1. Install metal lathing, so that the upper sheets overlap the lower sheets.
2. Install Lath with the long dimension across supports and with end joints staggered between courses.
3. End Laps:
   a. Minimum Width: 6 IN or as otherwise required by local building code.
   b. Locate end laps over supports as much as possible, fastening both plies using fasteners spaces 6 IN on center.

c. Where end laps do not coincide with studs; wire plies to one another at intervals not exceeding 9 IN on center.
d. Stagger successive end laps at least 16 IN apart.

4. Side Laps:
   a. Minimum Width: 2 IN or as otherwise required by local building code.
   b. Wire to lath along side lap edges 9 IN on center.
5. Paper-backed Lath:
   a. Install as recommended by manufacturer.
   b. When using offset material:
      1) Ensure that paper over paper, lath over lath rule is followed as successive courses are installed.

C. Fasteners:
1. Secure lath to substrate at intervals not exceeding 6 IN vertically; 16 IN horizontally.
2. Attach lath using corrosion protected fasteners specifically suited for lath attachment.
3. Ceilings and Soffits: Lath and accessories also may be wire tied to the furring channels for ceiling applications.

D. At metal door frames, insert lath as far as possible into throat space and notch for jamb anchors.

3.8 INSTALLATION – PLASTER ACCESSORIES – SHEET METAL

A. General:
1. Use single length beads wherever length of run does not exceed longest standard stock length available.
2. Miter or cope at corners.
3. Set beads with maximum tolerance of 1 in 100 from plumb or level.
4. Shim as required and align joints with concealed splices or tie plates.
5. Fully seal splices, terminals, and intersections.
6. Attach accessories to lath with tie wire, spaced no more than 8 IN OC.
7. Attach accessories to solid base with galvanized fasteners spaced no more than 8 IN OC.
8. Fasteners: Same type and penetration as specified for lath.

B. Outside Corner Beads:
1. Install at all outside corners.
2. Set corner beads in plaster as they are fastened to wall; ensuring the void behind bead is solidly filled. Hollow corner beads will be rejected.
3. Install using string line and/or level to ensure that nosings are plumb, level, and at proper depth.

C. Inside Corner Reinforcing Mesh:
1. Lap and secure lath over inside corners and overlay with corner reinforcing mesh.
   a. Exception: Where control joint occurs at inside corner, install mesh in accordance with following paragraph.

D. Control Joints (CJ):
1. General:
   a. Lay out and install control joints as indicated and specified.
   b. Ensure that lath is not continuous across control joints.
   c. Ensure sheathing and membrane are continuous across control joints.
   d. Install control joints at surface penetrations, and at areas of structural stress.
   e. Secure each flange to lath using wire ties at 6 IN O.C. Do not use screws, nails or staples.
   f. Install in accordance with manufacturer's instructions.
   g. Where control joints intersect control joints other accessories:
      1) Vertical joint shall be continuous.

2) Cope flanges of horizontal item to conform to profile of vertical item.
3) Allow 1/4 IN gap to allow for expansion of vertical item.
4) Set intersecting items in sealant.

h. Provide sealant at splices, terminals, and intersections.

2. Control joint locations in Portland Cement Plaster:
   a. Locate where indicated in drawings.
   b. Avoid T, L, and X shaped panels.
   c. Panels shall not exceed 18 FT in length.
   d. Panel dimensions shall not exceed a 2-1/2:1 ratio.
   e. Panels shall not exceed the following areas:

Maximum Panel Areas - PC Plaster	
Orientation	**Maximum Area**
Walls	144 FT^2
Ceilings and Soffits	100 FT^2

   f. If control joint locations not indicated, or panels exceed above listed parameters, notify Architect prior to installation.

E. Expansion Joints (EJ):
1. Install expansion joints at locations indicated and at lines of separation between dissimilar substrate materials.
2. Lay out expansion joints as work starts, as they may affect appearance, framing, sheathing, and lathing procedures.
3. Ensure sheathing and lath are not continuous across expansion joints.
4. Ensure moisture resisting membrane is continuous across expansion joints.
5. Secure each flange to lath using wire ties at 6 IN O.C. Do not use screws, nails or staples.
6. Install in accordance with manufacturer's instructions.
   a. When installing horizontally, orient female flange down to promote drainage.
7. Pre-flash expansion joints with 6 IN wide strip of self-adhering flashing.
8. Where expansion joints intersect expansion joints, control joints or other accessories:
   a. Vertical joint should be continuous.
   b. Cope flanges of horizontal item to conform to profile of vertical item.
   c. Allow 1/4 IN gap to allow for expansion of vertical item.
   d. Set intersection items in sealant.
9. Provide sealant at splices, terminals, and intersections.

3.9 INSTALLATION – PLASTER ACCESSORIES – ALUMINUM EXTRUSIONS

A. General:
1. Use single length extrusions wherever length of run does not exceed longest standard stock length available.
   a. Miter or cope at corners.
   b. Set beads with maximum tolerance of 1 in 100 from plumb or level.
   c. Shim as required and align joints with concealed splices or tie plates.
2. Attachment (where Lath is specified):
   a. The materials in this article are to be installed over lath.
   b. Attach accessories to lath with tie wire, spaced no more than 8 IN OC.
3. Attachment to solid bases where no lath is required:
   a. Attach accessories to base with galvanized fasteners spaced no more than 8 IN OC.

B. Install in accordance with manufacturer's instructions.

C. Provide backing, building paper, and sealant as recommended by manufacturer.

D. Where horizontal items intersect vertical items:
   1. Utilize pre-formed, factory-produced intersections.
      a. Where not available; vertical item should be continuous.

E. Sealant: See Section 07 92 00.

F. Include splices, reveal terminal end caps and other similar items.

END OF SECTION

SECTION 09 24 00
PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies lathing and Portland cement based plaster .

1.2 RELATED WORK

A. Steel framing members for attachment of plaster bases: Section 05 40 00, COLD-FORMED METAL FRAMING, and Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

B. Room finish schedule and color: Section 09 06 00, SCHEDULE FOR FINISHESS.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C841, and C926 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, and bar joists.

C. Self-furring Lath: Metal plastering bases having dimples or crimps designed to hold the plane of the back of the lath 6 to 10 mm (1/4 to 3/8 inch) away from the plane of the solid backing.

D. Solid Backing or Solid Bases: Concrete, masonry, sheathing, rigid insulation, and similar materials to which plaster is directly applied.

E. Wet Areas: Areas of a building where cyclic or continuous exposure to very humid or wet conditions, or in which a dew point condition may occur in the plaster. Dew point conditions occur frequently in such areas as laundries, natatoriums, cart and dish washing spaces, hydrotherapy, kitchens, bathing or shower rooms and similar areas.

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. Accessories for plaster, each type.
   2. Metal plastering bases, each type.
   3. Fasteners.
   4. Bonding compounds, including application instructions.
   5. Admixtures, including mixing and application instructions.

C. Samples:
   1. Accessories for plaster, each type, not less than 150 mm (6 inches) long.

D. Panel showing finish coat 12 by 12 mm (inches).

1.5 PROJECT CONDITIONS

A. Maintain work areas for interior work at a temperature of not less than 4°C (40°F) for not less than 48 hours prior to application of plaster, during application of plaster and until plaster is completely dry.

B. Exterior plaster shall not be applied when the ambient temperature is less than 4°C (40°F).

C. Plaster shall not be applied to frozen surfaces or surfaces containing frost.

D. Frozen materials shall not be used in the mix.

E. Plaster coats shall be protected against freezing for a period of not less than 24 hours after application.

1.6 APPLICABLE PUBLICATIONS

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

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

A653/A653M-07	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A641-03	Zinc-Coated (Galvanized) Carbon Steel Wire
C11-07	Terminology Relating to Gypsum and Related Building Materials and Systems.
C91-05	Masonry Cement
C150-07	Portland Cement
C207-06	Hydrated Lime for Masonry Purposes
C260-06	Air Entraining Admixtures for Concrete.
C841-03	Installation of Interior Lathing and Furring
C847-06	Metal Lath
C897-05	Aggregate for Job-Mixed Portland Cement Based Plasters
C926-06	Application of Portland Cement-Based Plaster
C933-07	Welded Wire Lath
C979-05	Pigments for Integrally Colored Concrete
C1002-07	Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

C. Commercial Item Description (CID):

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

D. Federal Specifications (Fed Spec.):

UU-B-790A	Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire Resistant)

PART 2 - PRODUCTS

2.1 METAL PLASTERING BASES

A. Expanded Metal Lath:
   1. ASTM C847, zinc-coated (galvanized) except as modified by ASTM C841 and this specification. Self furring where applied over solid backing.
   2. Flat diamond mesh weighing not less than 1.8 kg/m^2 (3.4 pounds per square yard).

3. Stucco Mesh: Flat expanded diamond mesh pattern, with openings approximately 38 by 75 mm (1-1/2 by 3 inches), weighing not less than 1.9 kg/ m^2 (3.6 pounds per square yard), with backing as specified.

B. Wire Lath:
1. Zinc coated (Galvanized).
2. Welded Wire Lath: ASTM C933, with backing as specified.
3. Self furring where applied over solid backing.

C. Building Paper Backing for Metal Plastering Bases:
1. Backing attached to lath as specified in ASTM C933.
2. Vapor Permeable Backing: Fed. Spec. UU-B-790, Type I, Grade D.
3. Water Resistant Backing: Fed. Spec. UU-B-790, Type I, Grade B.

2.2 ACCESSORIES FOR CEMENT PLASTER (STUCCO)

A. ASTM C841, except fabricate from zinc alloy.

B. Control Joints: ASTM C841, zinc.

2.3 FASTENERS

A. Tie, wire, screws, clips, and other fasteners ASTM C841, except as otherwise specified.

B. Fasteners for securing metal plastering bases shall have heads, or be through washers large enough to engage two strands of the metal plastering base.

C. For fire rated construction; type and size as used in fire rated test.

D. Screws: ASTM C1002.

E. Expansion Shields: CID A-A-55615, of the Type and Class applicable.

2.4 CEMENT

A. Portland: ASTM C150, Type I.

B. Masonry: ASTM C91. Lime where added, ASTM C207, Type S.

C. White where required for white finish coat.

2.5 LIME

A. ASTM C206, Type S.

B. ASTM C207, Type S.

2.6 AGGREGATES (SAND)

A. ASTM C897, graded as required to suit texture of finish specified.

B. White where white finish coat is specified.

2.7 BONDING AGENT

A. ASTM C932.

2.8 FACTORY PREPARED FINISH COAT FOR CEMENT PLASTER (STUCCO)

A. Factory prepared dry blend of materials, integrally colored, designed for exterior finish coat application.

B. Pigments: ASTM C979, lime proof mineral oxide.

C. Not more than 35 percent, by weight of all ingredients (cement, aggregate, hydrated lime, admixture and coloring pigment) shall pass a number 100 sieve.

2.9 ADMIXTURES

A. Air Entrainment: ASTM C260.

PART 3 - EXECUTION

3.1 METAL PLASTERING BASES (LATH) LOCATIONS

A. Where plaster is required on solid concrete or masonry bases, metal plastering bases are not required, unless shown on the drawings. Where shown use wire lath or stucco mesh.

B. On ceiling or soffit framing use flat diamond mesh lath.

C. On interior wall framing:
   1. Use flat diamond mesh lath.
   2. Use lath with water resistant backing in wet areas.

D. Over steel columns, use self-furring flat diamond mesh lath.

E. Where metal plastering bases are used as a base for exterior cement plaster over wall sheathing, use wire lath or stucco mesh with water resistant backing.

3.2 APPLYING METAL PLASTERING BASES

A. In accordance with ASTM C841, except as otherwise specified or shown.

B. Form true surfaces, straight or in fair curves where shown, without sags or buckles and with long dimension of lath at right angles to direction of supports.

C. Lath for ceiling or soffit construction shall terminate at casing bead (floating angle construction) at perimeter angles between walls and ceilings or soffits.

D. Lath with backing shall be applied to produce a paper to paper and metal to metal lap at ends and sides of adjacent sheets, whether full sheets or less than full sheets are used:
   1. Backing shall be lapped 50 mm (2 inches) for both horizontal and vertical laps.
   2. Horizontal laps shall be ship lap fashion to conduct water to the outside and over flashing or waterproofing.

E. Metal plastering bases shall not be continuous through expansion and control joints, but shall be stopped at each side.

F. Attach metal lath directly to masonry and concrete with hardened nails, power actuated drive pins or other approved fasteners. Fasteners shall be located at the dimples or crimps only.

G. Wood plugs are not acceptable.

3.3 INSTALLING PLASTERING ACCESSORIES

A. Install accessories in accordance with ASTM C841, except as otherwise specified.
   1. Set plastering accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified for metal lath.
   2. Install in one piece, within the limits of the longest commercially available lengths.

B. Corner Beads: Install at all vertical and horizontal external plaster corners, as required to establish grounds, and where shown.

C. Strip Lath:

1. Install metal lath strips centered over joints between dissimilar materials, such as hollow tile, brick, concrete masonry units, concrete, and joints with metal lath on framing or furring, where both such surfaces are required to be plastered and are in contact with each other in same plane, except where expansion joints and casing beads are required.
2. Wire tie or fasten strip lath to base along both edges at not over 150 mm (six inches) on centers.

D. Casing Beads:
1. Install casing beads where shown and at following locations where plaster terminates to provide finish trim.
2. Where plaster terminates against non-plastered surfaces such as masonry, concrete, and wood.
3. Where plaster terminates against trim of steel frames and trim of other materials and equipment, except where trim overlaps plaster.
4. Around perimeter of openings except where edge is covered by flanges. Locate to conform to dimensions shown on shop drawings.
5. Where plaster for new walls or furring (vertical or horizontal) terminates against existing construction.
6. Both sides of expansion and control joints unless shown otherwise.
7. Install casing bead at perimeter angles between walls and ceilings so as to provide floating angle (unrestrained) construction in accordance with ASTM C841.

E. Cornerites:
1. Install at interior corners of walls, partitions, and other vertical surfaces to be plastered, except where metal lath is carried around angle.
2. Fasten only as necessary to retain position during plastering.
3. Omit cornerites at junction of new plastered walls with existing plastered walls at locations where casing beads are specified.

F. Control Joints:
1. Where control joints are placed parallel to framing members, install joints within 100 mm (four inches) of the framing member.
2. Install control joints only to the edges of abutting sheets of lath so that the lath is not continuous or tied across the joint.
3. Joints shall extend the full width and height of the wall or length of soffit/ceiling plaster membrane.

3.4 SURFACE PREPARATION OF SOLID BASES

A. Surfaces that are to receive plaster shall be prepared and conditioned in accordance with ASTM C926, except as otherwise specified.

B. New surfaces of masonry and concrete:
1. Remove projections and clean concrete surface of form oil.
2. Fill depressions, holes, cracks and similar voids flush with Portland cement plaster to provide substrate within the tolerance specified in ASTM C926.
3. Use bonding agent.
4. Cover with self furring lath where required to keep the total plaster thickness as specified in Table 4 of ASTM C926.

C. Existing surfaces of concrete and masonry:
1. Clean surface of dirt and other foreign matter which will prevent bond.
2. Apply dash bond coat or bonding agent as specified herein.
3. Where existing surfaces have a coating such as paint or bituminous waterproofing apply metal plastering base as specified herein.

3.5 PORTLAND CEMENT BASED PLASTER

A. Provide portland cement based plaster where cement plaster (stucco) is shown and specified, and as follows:
   1. Three coat work shall be used over all metal plastering bases, with or without solid backing.
   2. Two coat work may only be used over solid bases meeting the requirements of Paragraph, SURFACE PREPARATION OF SOLID BASES.

B. Proportion, mix and apply plaster in accordance with ASTM C926, except as otherwise specified.
   1. Use air entrained plaster for all exterior work.
   2. Use coloring pigments for finish coat when integral color other than white is specified.
   3. Use white cement with white sand when white finish coat is specified.
   4. Factory prepared finish coat: Add water, mix, and apply as specified by manufacturer.
   5. Color:
      a. Color of finish coat shall be natural cement color when painted or other coating is specified.
      b. Other colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES.
   6. Finish coat shall be smooth troweled .

END OF SECTION

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 05 40 00, COLD-FORMED METAL FRAMING, and Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

B. Sound deadening board: Section 07 21 13, THERMAL INSULATION.

C. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

D. Lay in gypsum board ceiling panels: Section 09 51 00, ACOUSTICAL CEILING.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

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

B. Manufacturer's Literature and Data:
   1. Cornerbead and edge trim.
   2. Finishing materials.
   3. Laminating adhesive.
   4. Gypsum board, each type.

C. Shop Drawings:
   1. Typical gypsum board installation, showing corner details, edge trim details and the like.
   2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
   3. Typical shaft wall assembly.
   4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

D. Samples:
   1. Cornerbead.
   2. Edge trim.
   3. Control joints.

E. Test Results:
   1. Fire rating test, each fire rating required for each assembly.
   2. Sound rating test.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

A. In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

A. In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

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

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

C11-08	Terminology Relating to Gypsum and Related Building Materials and Systems
C475-02	Joint Compound and Joint Tape for Finishing Gypsum Board
C840-08	Application and Finishing of Gypsum Board
C919-08	Sealants in Acoustical Applications
C954-07	Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
C1002-07	Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
C1047-05	Accessories for Gypsum Wallboard and Gypsum Veneer Base
C1177-06	Glass Mat Gypsum Substrate for Use as Sheathing
C1658-06	Glass Mat Gypsum Panels
C1396-06	Gypsum Board
E84-08	Surface Burning Characteristics of Building Materials

C. Underwriters Laboratories Inc. (UL):
   Latest Edition Fire Resistance Directory

D. Inchcape Testing Services (ITS):
   Latest Editions Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum. (GWB-1)

B. Coreboard or Shaft Wall Liner Panels.
   1. ASTM C1396, Type X.
   2. ASTM C1658: Glass Mat Gypsum Panels,
   3. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.

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

D. Impact resistant gypsum wall board (GWB-2): ASTM C1278 & C1629, 5/8inch thick unless shown otherwise; USG Fiberock AR (BOD); See finish schedule for finish.

E. Abuse resistant gypsum wall board (GWB-3): ASTM C1278 & C1629, 5/8inch thick unless shown otherwise; USG Fiberock VHI (BOD), See finish schedule for finish.

F. Abuse & water resistant gypsum wall board (GWB-4): USG Fiberock Aqua Tough (BOD); See finish schedule for finish.

G. Gypsum cores shall contain a minimum of 95 percent post industrial recycled gypsum content. Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 GYPSUM SHEATHING BOARD

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

B. ASTM C1177, Type X.

2.3 ACCESSORIES

A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.

B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

2.4 FASTENERS

A. ASTM C1002 and ASTM C840, except as otherwise specified.

B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).

C. Select screws of size and type recommended by the manufacturer of the material being fastened.

D. For fire rated construction, type and size same as used in fire rating test.

E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

A. ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:
   1. Two sides of partitions:
      a. Fire rated partitions.
      b. Smoke partitions.
      c. Sound rated partitions.
      d. Full height partitions shown (FHP).
      e. Corridor partitions.
   2. One side of partitions or furring:
      a. Inside of exterior wall furring or stud construction.
      b. Room side of room without suspended ceilings.
      c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
   3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.

B. In locations other than those specified, extend gypsum board from floor to heights as follows:
   1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.

2. At ceiling of suspended gypsum board ceilings.
3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

A. Coordinate installation of gypsum board with other trades and related work.

B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.

C. Moisture and Mold–Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.

D. Use gypsum boards in maximum practical lengths to minimize number of end joints.

E. Bring gypsum board into contact, but do not force into place.

F. Ceilings:
1. For single-ply construction, use perpendicular application.
2. For two-ply assembles:
   a. Use perpendicular application.
   b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.

G. Walls (Except Shaft Walls):
1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
3. Stagger screws on abutting edges or ends.
4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
8. Installing Two Layer Assembly Over Sound Deadening Board:
   a. Apply face layer of wallboard vertically with joints staggered from joints in sound deadening board over framing members.
   b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.
9. Control Joints ASTM C840 and as follows:
   a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
   b. Not required for wall lengths less than 9000 mm (30 feet).
   c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.

H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.

2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.

I. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
2. Install in one piece, without the limits of the longest commercially available lengths.
3. Corner Beads:
   a. Install at all vertical and horizontal external corners and where shown.
   b. Use screws only. Do not use crimping tool.
4. Edge Trim (casings Beads):
   a. At both sides of expansion and control joints unless shown otherwise.
   b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
   c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
   d. Where shown.

3.3 INSTALLING GYPSUM SHEATHING

A. Install in accordance with ASTM C840, except as otherwise specified or shown.

B. Use screws of sufficient length to secure sheathing to framing.

C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.

D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.

E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

3.4 CAVITY SHAFT WALL

A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.

B. Conform to FM WALL CONSTRUCTION 25-1/HR (Non-loadbearing) for one-hour fire rating where shown.

C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
2. Stagger joints top and bottom in adjacent panels.
3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.

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

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

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

F. Elevator Shafts:
   1. Protrusions including fasteners other than flange of shaft wall framing system or offsets from vertical alignments more than 3 mm (1/8-inch) are not permitted unless shown.
   2. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

3.5 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. See Finish Schedule for level of gypsum board finish for each type of wall finish.

B. Before proceeding with installation of finishing materials, assure the following:
   1. Gypsum board is fastened and held close to framing or furring.
   2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non decorated smoke barrier, fire rated and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier, fire rated and sound rated construction/ Sanding is not required of non decorated surfaces.

3.6 REPAIRS

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

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction, fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction

END OF SECTION

SECTION 09 30 13
CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies ceramic, porcelain and quarry tile, marble thresholds and window stools, waterproofing membranes for thin-set applications, crack isolation membranes, tile backer board.

1.2 RELATED WORK

A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS.

B. Color, texture and pattern of field tile and trim shapes, size of field tile, trim shapes, and color of grout specified: Section 09 06 00, SCHEDULE FOR FINISHES.

C. Plastering: Section 09 24 00, PORTLAND CEMENT PLASTERING.

D. Metal and resilient edge strips at joints with new resilient flooring, and carpeting: Section 09 65 19, RESILIENT TILE FLOORING Section 09 68 00, CARPETING.

1.3 SUBMITTALS

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

B. Samples:
1. Base tile, each type, each color, each size.
2. Mosaic floor tile panels, 225 mm by 225 mm (9 inches by 9 inches), each type, color, size and pattern.
3. Paver tile, each size, type, color and pattern.
4. Quarry tile, each type, color, and size.
5. Porcelain tile, each type, color, patterns and size.
6. Wall (or wainscot) tile, each color, size and pattern.
7. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.

C. Product Data:
1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
2. Chemical resistant mortar and grout (Epoxy and Furan).
3. Cementitious backer unit.
4. Dry-set Portland cement mortar and grout.
5. Divider strip.
6. Elastomeric membrane and bond coat.
7. Reinforcing tape.
8. Leveling compound.
9. Latex-Portland cement mortar and grout.
10. Commercial Portland cement grout.
11. Organic adhesive.
12. Slip resistant tile.
13. Waterproofing isolation membrane.
14. 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.
   l. Factory mounted tile suitability for application in wet area specified under 2.1, A, 3 with list of successful in-service performance locations.

1.4 DELIVERY AND STORAGE

A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.

B. Store material to prevent damage or contamination.

1.5 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute (ANSI):

A10.20-05	Safety Requirements for Ceramic Tile, Terrazzo, and Marble Works
A108.1A-05	Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
A108.1B-05	Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar
A108.1C-05	Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar
A108.4-05	Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesives
A108.5-05	Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
A108.6-05	Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy
A108.8-05	Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout
A108.10-05	Installation of Grout in Tilework
A108.11-05	Interior Installation of Cementitious Backer Units
A108.13-05	Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone
A118.1-05	Dry-Set Portland Cement Mortar
A118.3-05	Chemical Resistant, Water Cleanable Tile-Setting Epoxy and Water Cleanable Tile-Setting and Grouting Epoxy Adhesive
A118.4-05	Latex-Portland Cement Mortar
A118.5-05	Chemical Resistant Furan Mortars and Grouts for Tile Installation

A118.6-05	Standard Cement Grouts for Tile Installation
A118.9-05	Cementitious Backer Units
A118.10-05	Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation
A136.1-05	Organic Adhesives for Installation of Ceramic Tile
A137.1-88	Ceramic Tile

C. American Society For Testing And Materials (ASTM):

A185-07	Steel Welded Wire Fabric, Plain, for Concrete Reinforcing
C109/C109M-07	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)
C241-90 (R2005)	Abrasion Resistance of Stone Subjected to Foot Traffic
C348-02	Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
C627-93(R2007)	Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
C954-07	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
C979-05	Pigments for Integrally Colored Concrete
C1002-07	Steel Self-Piercing Tapping Screws for the Application of Panel Products
C1027-99(R2004)	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
C1127-01	Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface
C1178/C1178M-06	Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
D4397-02	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 0.7 (wet condition) for bathing areas.
         2) Not less than 0.8 on ramps for wet and dry conditions.

3) Not less than 0.6, except 0.8 on ramps as stated above, for wet and dry conditions for other areas.

b. Tile Having Abrasive Grains:

1) Unglazed Ceramic Mosaic Tile: Abrasive grains throughout body of the tile.

2) Quarry Tile: Abrasive grains uniformly embedded in face at rate of approximately 7.5 percent of surface area.

c. Porcelain Paver Tile: Matte surface finish

4. Mosaic tile may be mounted or joined together by a resinous bonding material along tile edges.
5. Do not use back mounted tiles in showers unless certified by manufacturer as noted in paragraph 1.3.D.
6. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
7. Factory-Applied Temporary Protective Coating:

a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.

b. Do not coat unexposed tile surfaces.

c. Pre-wax tiles set or grouted with furan or epoxy or latex modified mortars.

B. Unglazed Ceramic Mosaic Tile: Nominal 6 mm (1/4 inch) thick with cushion edges.

C. Unglazed Quarry Tile: Nominal 13 mm (1/2 inch) thick, square edges.

D. Glazed Wall Tile: Cushion edges, glazing, as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

E. 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.

F. Trim Shapes:

1. Conform to applicable requirements of adjoining floor and wall tile.
2. Use slip resistant trim shapes for horizontal surfaces of showers , overflow ledges, recessed steps, shower curbs, drying area curbs, and seats.
3. Use trim shapes sizes conforming to size of adjoining field wall tile unless detailed or specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
4. Internal and External Corners:

a. Square internal and external corner joints are not acceptable.

b. External corners including edges: Use bullnose shapes.

c. Internal corners: Use cove shapes.

d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.

e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.

f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.

g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.

h. For unglazed ceramic mosaic and glazed wall tile installed in Portland cement mortar setting bed, use cove and bullnose shapes as applicable. When ceramic mosaic wall and base tile is required, use C Series cove and bullnose shapes.

i. For unglazed ceramic mosaic and glazed wall tile installed in dry-set Portland cement mortar, latex-Portland cement mortar, and organic adhesive (thin set methods), use cove and surface bullnose shapes as applicable.
j. For quarry tile work, use cove and bullnose shapes as applicable.
k. Provide cove and bullnose shapes required to complete tile work.

2.2 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.

2.3 GLASS MAT WATER RESISTANT GYPSUM BACKER BOARD

A. Confirm to ASTM C1178/C1178M

2.4 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 A118.4.
   1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A118.4.
   2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

D. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A118.4.

E. Organic Adhesives: ANSI A136.1, Type 1.

F. Chemical-Resistant Bond Coat:
   1. Epoxy Resin Type: ANSI A118.3.
   2. Furan Resin Type: ANSI A118.5.

2.5 GROUTING MATERIALS

A. Coloring Pigments:
   1. Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
   2. Add coloring pigments to grout by the manufacturer.
   3. Job colored grout is not acceptable.
   4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.

B. White Portland Cement Grout:
   1. ANSI A118.6.
   2. Use one part white Portland cement to one part white sand passing a number 30 screen.
   3. Color additive not permitted.

C. Commercial Portland Cement Grout: ANSI A118.6 color as specified.

D. Dry-Set Grout: ANSI A118.6 color as specified.

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

F. Chemical-Resistant Grout:
   1. Epoxy grout, ANSI A118.3.
   2. Furan grout, ANSI A118.5.

2.6 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.

2.7 MARBLE

A. Soundness Classification in accordance with MIA Design Manual III Groups.

B. Thresholds:
   1. Group A, Minimum abrasive hardness (Ha) of 10.0 per ASTM C241.
   2. Honed finish on exposed faces.
   3. Thickness and contour as shown.
   4. Fabricate from one piece without holes, cracks, or open seams; full depth of wall or frame opening by full width of wall or frame opening; 19 mm (3/4-inch) minimum thickness and 6 mm (1/4-inch) minimum thickness at beveled edge.
   5. Set not more than 13 mm (1/2-inch) above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2. On existing floor slabs provide 13 mm (1/2-inch) above ceramic tile surface with bevel edge joint top flush with adjacent floor.
   6. One piece full width of door opening. Notch thresholds to match profile of door jambs.

2.8 WATER

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

2.9 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.

2.10 FLOOR MORTAR BED REINFORCING

A. ASTM A185 welded wire fabric without backing, MW3 x MW3 (2 x 2-W0.5 x W0.5).

2.11 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 degC (60 degF).

E. Do not allow temperature to fall below 10 degC (50 degF) after fourth day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
   1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
   2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.

B. Variation in Plane of Wall Surfaces:
   1. Not more than 1 in 400 (1/4 inch in eight feet) from required plane where Portland cement mortar setting bed is used.
   2. Not more than 1 in 800 (1/8 inch in eight feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION

A. Cleaning New Concrete or Masonry:
   1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.
   2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
   3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.

B. Patching and Leveling:
   1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.

2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
   a. Thickness of compound as required to bring finish tile system to elevation shown.
   b. Float finish; except finish smooth for elastomeric waterproofing.
   c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.

C. Mortar Bed for Slopes to Drains:
1. Slope compound to drain where drains are shown.
2. Install mortar bed in depressed slab sloped to drains not less than 1 in 200 (1/16 inch per foot).
3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
4. Screed for slope to drain and float finish.
5. Cure mortar bed for not less than seven days. Do not use curing compounds or coatings.

D. Additional preparation of concrete floors for tile set with epoxy, or furan-resin shall be in accordance with the manufacturer's printed instructions.

E. Cleavage Membrane:
1. Install polythene sheet as cleavage membrane in depressed slab when waterproof membrane is not scheduled or indicated.
2. Turn up at edge of depressed floor slab to top of floor.

F. Walls:
1. In showers or other wet areas cover studs with polyethylene sheet.
2. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
4. Apply metal lath to framing in accordance with ANSI A108.1:
   a. Use fasteners specified in paragraph "Fasteners." Use washers when lath opening is larger than screw head.
   b. Apply scratch and leveling coats to metal lath in accordance with ANSI A108.1.C.
   c. Total thickness of scratch and leveling coats:
      1) Apply 9 mm to 16 mm (3/8 inch to 5/8 inch) thick over solid backing.
      2) 16 mm to 19 mm (5/8 to 3/4 inch) thick on metal lath over studs.
      3) Where wainscots are required to finish flush with wall surface above, adjust thickness required for flush finish.
   d. Apply scratch and leveling coats more than 19 mm (3/4 inch) thick in two coats.

3.4 CEMENTITIOUS BACKER UNITS

A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.

B. Install in accordance with ANSI A108.11 except as specified otherwise.

C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a V joint for joint treatment.

D. Secure cementitious backer units to each framing member with screws spaced not more than 200 mm (eight inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.

E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.

F. Do not install joint treatment for seven days after installation of cementitious backer unit.

G. Joint Treatment:
   1. Fill horizontal and vertical joints and corners with latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
   2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

3.5 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 MARBLE

A. Secure thresholds and stools in position with minimum of two stainless steel dowels.

B. Set in dry-set Portland cement mortar or latex-Portland cement mortar bond coat.

C. Set threshold to finish 12mm (1/2 inch) above ceramic tile floor unless shown otherwise, with bevel edge joint top flush with adjacent floor similar to TCA detail TR611-02.

3.7 METAL DIVIDER STRIPS

A. Install metal divider strips in floor joints between ceramic and quarry tile floors and between tile floors and adjacent flooring of other materials where the finish floors are flush unless shown otherwise.

B. Set divider strip in mortar bed to line and level centered under doors or in openings.

3.8 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. Set wall tile installed over concrete or masonry in dry-set Portland cement mortar, or latex-Portland cement mortar, ANSI 108.1B.and TCA System W211-02, W221-02 or W222-02.
3. Set wall tile installed over concrete backer board in latex-Portland cement mortar, ANSI A108.1B.
4. Set wall tile installed over Portland cement mortar bed on metal lath base in Portland cement paste over plastic mortar bed, or dry-set Portland cement mortar or latex-Portland cement mortar over a cured mortar bed, ANSI A108.1C, TCA System W231-02, W241-02.
5. Set tile installed over gypsum board and gypsum plaster in organic adhesive, ANSI A108.4, TCA System W242-02.
6. Set trim shapes in same material specified for setting adjoining tile.

E. Workmanship:
1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field.
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise.
3. Form intersections and returns accurately.
4. Cut and drill tile neatly without marring surface.
5. Cut edges of tile abutting penetrations, finish, or built-in items:
   a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
   b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work shall be free from hollow sounding areas and loose, cracked or defective tile.
7. Remove and reset tiles that are out of plane or misaligned.
8. Floors:
   a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
   b. Align finish surface of new tile work flush with other and existing adjoining floor finish where shown.
   c. In areas where floor drains occur, slope to drains where shown.
   d. Shove and vibrate tiles over 200 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
   a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights shown with tile.
   b. Finish reveals of openings with tile, except where other finish materials are shown or specified.
   c. At window openings, provide tile stools and reveals, except where other finish materials are shown or specified.
   d. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
10. Joints:
   a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
   b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
   c. Make joints in 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.

11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
    a. Tile wall installations in wet areas, including showers, tub enclosures, laundries and swimming pools.
    b. Tile installed with chemical-resistant mortars and grouts.
    c. Tile wall installations composed of tiles 200 by 200 mm (8 by 8 inches or larger.
    d. Exterior tile wall installations.

3.9 CERAMIC TILE INSTALLED WITH PORTLAND CEMENT MORTAR

A. Mortar Mixes for Floor, Wall And Base Tile (including Showers,): ANSI A108.1.except specified otherwise.

B. Installing Wall and Base Tile: ANSI A108.1, except specified otherwise.

C. Installing Floor Tile: ANSI A108.1, except as specified otherwise. Slope mortar beds to floor drains a minimum of 1 in 100 (1/8 inch per foot).

3.10 PORCELAIN TILE INSTALLED WITH LATEX PORTLAND CEMENT BONDING MORTAR

A. Due to the denseness of porcelain tile use latex Portland cement bonding mortar that meets the requirements of ANSI A118.4.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.

3.11 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR

A. Installation of Tile: ANSI A108.5, except as specified otherwise.

B. Slope tile work to drains not less than 1 in 100 (1/8 inch per foot).

3.12 GROUTING

A. Grout Type and Location:
    1. Grout for glazed wall and base tile, paver tile and unglazed mosaic tile Portland cement grout, latex-Portland cement grout, dry-set grout, or commercial Portland cement grout.

B. Workmanship:
    1. Install and cure grout in accordance with the applicable standard.
    2. Portland Cement grout: ANSI A108.10.
    3. Epoxy Grout: ANSI A108.6.
    4. Furan and Commercial Portland Cement Grout: ANSI A108.8 and in accordance with the manufacturer's printed instructions.
    5. Dry-set grout: ANSI A108.5.

3.13 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, service sink, at toe of base, and where shown not less than 6 mm (1/4 inch) deep.

3.14 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.

3.15 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.

3.16 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.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Metal ceiling suspension system for acoustical ceilings.

B. Acoustical units.

C. Adhesive application.

1.2 RELATED WORK

A. Color, pattern, and location of each type of acoustical unit: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTAL

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

B. Samples:
   1. Acoustical units, each type, with label indicating conformance to specification requirements.
   2. Colored markers for units providing access.

C. Manufacturer's Literature and Data:
   1. Ceiling suspension system, each type, showing complete details of installation.
   2. Acoustical units, each type

D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

1.4 DEFINITIONS

A. Standard definitions as defined in ASTM C634.

B. Terminology as defined in ASTM E1264.

1.5 APPLICABLE PUBLICATIONS

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

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

A641/A641M-03	Zinc-coated (Galvanized) Carbon Steel Wire
A653/A653M-07	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
C423-07	Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
C634-02 (E2007)	Standard Terminology Relating to Environmental Acoustics
C635-04	Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
C636-06	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
E84-07	Surface Burning Characteristics of Building Materials

E119-07	Fire Tests of Building Construction and Materials
E413-04	Classification for Rating Sound Insulation.
E580-06	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
E1264-(R2005)	Classification for Acoustical Ceiling Products

PART 2 - PRODUCTS

2.1 METAL SUSPENSION SYSTEM

A. ASTM C635, heavy-duty system, except as otherwise specified.
   1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
      a. Galvanized cold-rolled steel, bonderized.
      b. Extruded aluminum.
      c. Fire resistant plastic (glass fiber) having a flame spread and smoke developed rating of not more than 25 when tested in accordance with ASTM E84.
   2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
   3. Use aluminum suspension in kitchens and aluminum or fire resistant plastic in toilets adjacent to shower areas, hydrotherapy, and swimming pools.

B. Exposed grid suspension system for support of lay-in panels:
   1. Exposed grid width not less than 22 mm (7/8 inch) with not less than 8 mm (5/16 inch) panel bearing surface.
   2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
   3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.

2.2 PERIMETER SEAL

A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.

B. Thickness as required to fill voids between back of wall molding and finish wall.

C. Not less than 9 mm (3/8 inch) wide strip.

2.3 WIRE

A. ASTM A641.

B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).

C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

2.4 ANCHORS AND INSERTS

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

B. Hanger Inserts:
   1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
   2. Nailing type option for wood forms:

a. Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).
b. Lower portion provided with not less than 8 mm (5/16 inch) hole to permit attachment of hangers.

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

C. Clips:
1. Galvanized steel.
2. Designed to clamp to steel beam or bar joists, or secure framing member together.
3. Designed to rigidly secure framing members together.
4. Designed to sustain twice the loads imposed by hangers or items supported.

D. Tile Splines: ASTM C635.

2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.

B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4475		508	1120
50	2	267.6590		571.5	1260

2.6 ADHESIVE

A. ASTM D1779, having flame spread index of 25 or less when tested in accordance with ASTM E84.

B. Developing minimum strength of 7 kg/m^2 (one psi) of contact surface 48 hours after installation in temperature of 21 °C (70 °F).

2.7 ACOUSTICAL UNITS

A. General:
1. ASTM E1264, weighing 3.6 kg/m^2 (3/4 psf) minimum for mineral fiber panels or tile.
2. Class A Flame Spread: ASTM E84
3. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
4. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
5. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces, except as specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
6. Lay-in panels: Sizes as shown, with reveal edges. (Beveled Tegular)
a. Armstrong Ultima, or equal

b. Armstrong Optima Health Zone, or equal

2.8 ACCESS IDENTIFICATION

A. Markers:
   1. Use colored markers with pressure sensitive adhesive on one side.
   2. Make colored markers of paper of plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.

B. Use markers of the same diameter throughout building.

C. Color Code: Use following color markers for service identification:

Color	Service
Red	Sprinkler System: Valves and Controls
Green	Domestic Water: Valves and Controls
Yellow	Chilled Water and Heating Water
Orange	Ductwork: Fire Dampers
Blue	Ductwork: Dampers and Controls
Black	Gas: Laboratory, Medical, Air and Vacuum

PART 3 - EXECUTION

3.1 CEILING TREATMENT

A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.

B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.

C. Moldings:
   1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
   2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.

D. Perimeter Seal:
   1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
   2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

3.2 CEILING SUSPENSION SYSTEM INSTALLATION

A. General:
   1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
   2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
   3. Support a maximum area of 1.48 m^2 (16 sf) of ceiling per hanger.
   4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
   5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
   6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,

7. Use main runners not less than 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Anchorage to Structure:
1. Concrete:
   a. Install hanger inserts and wire loops required for support of hanger and bracing wire in concrete forms before concrete is placed. Install hanger wires with looped ends through steel deck if steel deck does not have attachment device.
   b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.
2. Steel:
   a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
      1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
      2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
   b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
   c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

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

D. Indirect Hung Suspension System:
1. As illustrated in ASTM C635.
2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) or center so as to insure that specified requirements are not exceeded.
3. Support main runners by specially designed clips attached to carrying channels.

E. Seismic Ceiling Bracing System:
1. Construct system is accordance with ASTM E580.
2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

3.3 ACOUSTICAL UNIT INSTALLATION

A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.

B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
1. Install tile to lay level and in full contact with exposed grid.
2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.

C. Markers:
   1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
   2. Attach colored markers to exposed grid on opposite sides of the units providing access.
   3. Attach marker on exposed ceiling surface of upward access acoustical unit.

3.4 CLEAN-UP AND COMPLETION

A. Replace damaged, discolored, dirty, cracked and broken acoustical units.

B. Leave finished work free from defects.

END OF SECTION

SECTION 09 60 05.01
VAPOR TRANSMISSION TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing of concrete floor slabs to gain assurance that delamination of finish flooring materials will not occur due to detrimental amounts of water vapor transmission.

1.2 RELATED SECTION

A. Division 9 – Finishes.

1.3 SUBMITTALS

A. Follow Section 01 33 23.

B. Floor Plan Diagram: Show the location of each test, and type of test proposed.

C. Informational Submittals: Test result.

1.4 QUALITY ASSURANCE

A. Testing methods may be mat tests, bond tests, electronic metering, chemical tests, or calcium chloride tests. Use method of testing as recommended by the flooring material manufacturer.

B. Where Maximum Vapor Emission Rates (MVER) are stipulated by the manufacturer, but no testing method is prescribed, the method used shall be the calcium chloride test, following ASTM F1869 unless otherwise specified in another specification section. Under the calcium chloride test method, test results shall be expressed in pounds of water per 1,000 square feet transmitted from the concrete in 24 hours.

C. For all testing procedures prescribed for use, follow flooring manufacturer's instructions regarding number of tests, building conditions (HVAC, Heat), and other stipulations.

PART 2 - PRODUCTS

2.1 GENERAL

A. Use materials, kits, and measuring devices required to obtain results as recommended by the flooring manufacturer to judge the acceptability of the concrete.

PART 3 - EXECUTION

3.1 TESTING

A. Perform tests, and record results on floor plan diagram. Submit as specified under Informational Submittals.

B. Test new concrete floor slabs, both on grade and those suspended above grade scheduled to receive finish flooring materials. See Section 03 30 00 CAST-IN-PLACE CONCRETE and related finish specification for additional surface preparation & testing requirements.

C. If test results do not fall within acceptable range as required by the flooring manufacturer, advise A/E and the Owner, in writing, indicating results and proposed remedial method to achieve acceptance.

END OF SECTION

SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the installation of vinyl or rubber base and resilient stair treads with sheet rubber flooring on landings.

1.2 RELATED WORK

A. Color and texture: Section 09 06 00, SCHEDULE FOR FINISHESS.

B. Integral base with sheet flooring: Section 09 65 19, RESILIENT TILE FLOORING.

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Base and stair material manufacturer's recommendations for adhesives.
   3. Application and installation instructions.

C. Samples:
   1. Base: 150 mm (6 inches) long, each type and color.
   2. Resilient Stair Treads: 150 mm (6 inches) long.
   3. Sheet Rubber Flooring: 300 mm (12 inches) square.
   4. Adhesive: Literature indicating each type.

1.4 DELIVERY

A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.

B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

A. Store materials in weather tight and dry storage facility.

B. Protect material from damage by handling and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

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

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

F1344-04	Rubber Floor Tile
F1859-04	Rubber Sheet Floor Covering without Backing
F1860-04	Rubber Sheet Floor Covering with Backing
F1861-02	Resilient Wall Base

C. Federal Specifications (Fed. Spec.):
RR-T-650E Treads, Metallic and Non-Metallic, Nonskid

PART 2 - PRODUCTS

2.1 GENERAL

A. Use only products by the same manufacturer and from the same production run.

2.2 RESILIENT BASE

A. ASTM F1861, 3 mm (1/8 inch) thick, 6 inches high (unless otherwise noted), Type TP Rubber, Thermoplastics, Group 2-layered with molded top. Style B-cove.

B. Where carpet occurs, use Style A-straight.

C. Use only one type of base throughout.

2.3 SHEET RUBBER FLOORING

A. ASTM F1344, F1859 or F1860, 900 mm (36 inches) wide, 3 mm (1/8 inch) thick, smooth face, material by the same manufacturer as the rubber treads, color and pattern to match treads.

B. Use for stair landings.

C. Use rubber flooring made with a minimum of 90% consumer rubber where possible.

2.4 PRIMER (FOR CONCRETE FLOORS)

A. As recommended by the adhesive and tile manufacturer.

2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)

A. Provide products with latex or polyvinyl acetate resins in the mix.

2.6 ADHESIVES

A. Use products recommended by the material manufacturer for the conditions of use.

B. Use low-VOC adhesive during installation. Water based adhesive with low VOC is preferred over solvent based adhesive.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Maintain temperature of materials above 21° C (70 °F), for 48 hours before installation.

B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°F) for at least 48 hours, before, during, and after installation.

C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

3.2 INSTALLATION REQUIREMENTS

A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the Resident Engineer.

B. Submit proposed installation deviation from this specification to the Resident Engineer indicating the differences in the method of installation.

C. The Resident Engineer reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

3.3 PREPARATION

A. Examine surfaces on which material is to be installed.

B. Fill cracks, pits, and dents with leveling compound.

C. Level to 3 mm (1/8 inch) maximum variations.

D. Do not use adhesive for leveling or filling.

E. Grind, sand, or cut away protrusions; grind high spots.

F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.

G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.

H. Preparation of existing installation:
   1. Remove existing base and stair treads including adhesive.
   2. Do not use solvents to remove adhesives.
   3. Prepare substrate as specified.

3.4 BASE INSTALLATION

A. Location:
   1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, laboratory, pharmacy furniture island cabinets and where other equipment occurs.
   2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.

B. Application:
   1. Apply adhesive uniformly with no bare spots.
   2. Set base with joints aligned and butted to touch for entire height.
   3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.
      a. Short pieces to save material will not be permitted.
      b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.

C. Form corners and end stops as follows:
   1. Score back of outside corner.
   2. Score face of inside corner and notch cove.

D. Roll base for complete adhesion.

3.5 SHEET RUBBER INSTALLATION.

A. Prepare surfaces to receive sheet rubber in accordance with applicable portions of paragraph, preparation.

B. Layout of Sheet Rubber:
   1. Use minimum number of joints compatible with material direction and symmetrical joint location.

2. Where sheet rubber intersect vertical stair members, other sheets, stair treads, and other resilient materials at the floor landings, material shall touch for the entire length within 5 mils (0.005 inch).
3. Install sheet rubber on floors and intermediate landings where resilient stair treads are installed; center joint with other flooring material under doors.

C. Application:
1. Apply adhesive uniformly with no bare spots.
2. Roll sheet rubber to assure adhesion.

3.6 CLEANING AND PROTECTION

A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.

B. Keep traffic off resilient material for at least 72 hours after installation.

C. Clean and polish materials in the following order:
1. After two weeks, scrub resilient base, sheet rubber and treads materials with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.
2. Do not polish tread and sheet rubber materials.

D. When construction traffic is anticipated, cover tread materials with reinforced kraft paper and plywood or hardboard properly secured and maintained until removal is directed by the Resident Engineer.

E. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

END OF SECTION

SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the installation of rubber tile flooring, and accessories.

1.2 RELATED WORK

A. Color and pattern and location in room finish schedule: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Resilient material manufacturers recommendations for adhesives, underlayment, primers and polish.
   3. Application and installation instructions.

C. Samples:
   1. Tile: 300 mm by 300 mm (12 inches by 12 inches) for each type, pattern and color.
   2. Edge Strips: 150 mm (6 inches) long, each type.
   3. Feature Strips: 150 mm (6 inches) long.

D. Shop Drawings:
   1. Layout of patterns shown on the drawings and in Section 09 06 00, SCHEDULE FOR FINISHES.
   2. Edge strip locations showing types and detail cross sections.

E. Test Reports:
   1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory.
   2. Tested per ASTM F510.

1.4 DELIVERY

A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.

B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

A. Store materials in weathertight and dry storage facility.

B. Protect from damage from handling, water, and temperature.

1.6 APPLICABLE PUBLICATIONS

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

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

D4078-02	Water Emulsion Floor Finish
E648-08	Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source
E662-06	Specific Optical Density of Smoke Generated by Solid Materials
E1155-96 (R2008)	Determining Floor Flatness and Floor Levelness Numbers
F510-93 (R 2004)	Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method
F710-08	Preparing Concrete Floors to Receive Resilient Flooring
F1066-04	Vinyl Composition Floor Tile
F1344-04	Rubber Floor Tile
F1700-04	Solid Vinyl Floor Tile

C. Resilient Floor Covering Institute (RFCI):

IP #2	Installation Practice for Vinyl Composition Tile (VCT)

D. Federal Specifications (Fed. Spec.):

SS-T-312	Tile Floor: Asphalt, Rubber, Vinyl and Vinyl Composition

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish product type, materials of the same production run and meeting following criteria.

B. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.

C. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E 648.

D. Smoke density: Less than 450 per ASTM E662.

2.2 RUBBER TILE

A. ASTM F1344, Class 1, homogenous rubber tile, B, through mottled, 39.53 inches square, 3.5 mm (.14 inch) thick.

B. Color and pattern uniformly distributed throughout tile.

C. Molded pattern wearing surface base thickness 3 mm (1/8 inch) thick.

D. Where rubber tile is used provide tiles with a minimum of 90% post consumer rubber.

2.3 ADHESIVES

A. Comply with applicable regulations regarding toxic and hazardous materials Green Seal (GS-36) for commercial adhesive.

B. Use low-VOC adhesive during installation. Water based is preferred over solvent based adhesives. Use adhesive recommended by product manufacturer for application.

2.4 PRIMER (FOR CONCRETE SUBFLOORS)

A. As recommended by the adhesive and tile manufacturer.

2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)

A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.

B. Determine the type of underlayment selected for use by the condition to be corrected.

C. As recommended by the adhesive and tile manufacturer.

2.6 POLISH AND CLEANERS

A. Cleaners RFCI CL-1.

B. Polish: ASTM D4078.

C. As recommended by the tile manufacturer

2.7 EDGE STRIPS

A. 28 mm (1-1/8 inch) wide unless shown otherwise.

B. Bevel from maximum thickness to minimum thickness for flush joint unless shown otherwise.

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

D. Resilient Edge Strip or Reducer Strip: Fed. Specs. SS-T-312, Solid vinyl.

2.8 SCREWS

A. Stainless steel flat head screw.

2.9 FEATURE STRIPS

A. Use same material as floor tile.

B. Sizes and shapes as shown.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Maintain temperature of materials a minimum of 22 °C (70 °F,) for 48 hours before installation.

B. Maintain temperature of rooms where work occurs between 21 °C and 27 °C (70 °F and 80 °F), for at least 48 hours, before, during and after installation.

C. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

3.2 SUBFLOOR PREPARATION

A. Verify that concrete slabs comply with ASTM F710. At existing slabs, determine levelness by F-number method in accordance with ASTM E1155. Overall value shall not exceed as follows:
   1. FF30/FL20

B. Correct conditions which will impair proper installation.

C. Fill cracks, joints and other irregularities in concrete with leveling compound:
   1. Do not use adhesive for filling or leveling purposes.
   2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
   3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joints.

D. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing curing or cleaning agents.

E. Concrete Subfloor Testing:
   1. Determine Adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MRP.

F. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy removal of tile.

G. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the tile or adhesive manufacturers.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.

B. Mix tile from at least two containers. An apparent line either of shades or pattern variance will not be accepted.

C. Tile Layout:
   1. If layout is not shown on drawings, lay tile symmetrically about center of room or space with joints aligned.
   2. No tile shall be less than 150 mm (6 inches) and of equal width at walls.
   3. Place tile pattern in the same direction; do not alternate tiles.

D. Trim tiles to touch for the length of intersections at pipes and vertical projections, seal joints at pipes with waterproof cement.

E. Application:
   1. Apply adhesive uniformly with no bare spots.
      a. Conform to RFC1-TM-6 for joint tightness and for corner intersection unless layout pattern shows random corner intersection.
      b. More than 5 percent of the joints not touching will not be accepted.
   2. Roll tile floor with a minimum 45 kg (100 pound) roller. No exceptions.
   3. The Resident Engineer may have test tiles removed to check for non-uniform adhesion, spotty adhesive coverage, and ease of removal. Install new tile for broken removed tile.

F. Installation of Edge Strips:
   1. Locate edge strips under center line of doors unless otherwise shown.
   2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws specified.
   3. Where tile edge is exposed, butt edge strip to touch along tile edge.
   4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

3.4 CLEANING AND PROTECTION

A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.

B. Keep traffic off resilient material for a minimum 72 hours after installation.

C. Clean and polish materials in the following order:
   1. For the first two weeks sweep and damp mopped only.
   2. After two weeks, scrub resilient materials with a minimum amount of water and a mild detergent. Leave surface clean and free of detergent residue.
   3. Apply polish to the floors in accordance with the polish manufacturer's instructions.

D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by Resident Engineer. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by Resident Engineer.

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

3.5 LOCATION

A. Unless otherwise specified or shown, install tile flooring, on floor under areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.

B. Extend tile flooring for room into adjacent closets and alcoves.

END OF SECTION

SECTION 09 67 23.30
RESINOUS (EPOXY RESIN COMPOSTITION) MORTAR FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies a seamless resinous (epoxy resin composition) and aliphatic poly urethane sealer, flooring systems with integral cove base.

1.2 RELATED WORK

A. Concrete and Moisture Vapor Barrier: Section 03 30 00, CAST-IN-PLACE CONCRETE.

B. Joint sealants: Section 07 92 00

C. Color and location of each type of resinous (epoxy resin composition) flooring: Section 09 06 00, SCHEDULE FOR FINISHES.

D. Floor Drains: Division 22, PLUMBING.

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data:
   1. Description of each product to be provided.
   2. Application and installation instructions.
   3. Maintenance Instructions: Submit manufacturer’s written instructions for recommended maintenance practices.

C. Qualification Data: For Installer.

D. Samples:
   1. Each color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.
   2. Samples for verification: For each (color and texture) resinous flooring system required, 6 inches (152 mm) square, applied to a rigid backing by installer for this project.
   3. Sample showing construction from substrate to finish surface in thickness specified and color and texture of finished surfaces. Finished flooring must match the approved samples in color and texture.

E. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:
   1. Patterns.
   2. Edge configuration//s.

F. Certifications and Approvals:
   1. Manufacturer's certification of material and substrate compliance with specification.
   2. Manufacturer's approval of installers.
   3. Contractor's certificate of compliance with Quality Assurance requirements.

G. Warranty: As specified in this section.

1.4 QUALITY ASSURANCE

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

B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this project for a minimum period of (5) five years, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
   1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
   2. Contractor shall have completed at least (5) five projects of similar size and complexity. Include list of at least (5) five projects. List must include owner (purchaser); address of installation, contact information at installation project site; and date of installation.
   3. Installer's Personnel: Employ persons trained for application of specified product.

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

D. Pre-Installation Conference:
   1. Convene a meeting not less than thirty days prior to starting work.
   2. Attendance:
      a. Contractor
      b. VA Resident Engineer
      c. Manufacturer and Installer's Representative
   3. Review the following:
      a. Environmental requirements
         1) Air and surface temperature
         2) Relative humidity
         3) Ventilation
         4) Dust and contaminates
      b. Protection of surfaces not scheduled to be coated
      c. Inspect and discus condition of substrate and other preparatory work performed
      d. Review and verify availability of material; installer’s personnel, equipment needed
      e. Design and patternand edge conditions.
      f. Performance of the coating with chemicals anticipated in the area receiving the resinous (epoxy resin composition) flooring system
      g. Application and repair
      h. Field quality control
      i. Cleaning
      j. Protection of coating systems
      k. One-year inspection and maintenance
      l. Coordination with other work

E. Manufacturer’s Field Services: Manufacturer’s representative shall provide technical assistance and guidance for surface preparation and application of resinous flooring systems.

F. Contractor Job Site Log: Contractor shall document daily; the work accomplished environmental conditions and any other condition event significant to the long term performance of the resinous flooring systems installation. The Contractor shall maintain these records for one year after Substantial Completion.

1.5 MATERIAL PACKAGING DELIVERY AND STORAGE

A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.

B. Protect materials from damage and contamination in storage or delivery, including moisture, heat, cold, direct sunlight, etc.

C. Maintain temperature of storage area between 60 and 80 degrees F (15 and 26 degrees C).

D. Keep containers sealed until ready for use.

E. Do not use materials beyond manufacturer's shelf life limits.

F. Package materials in factory pre-weighed and in single, easy to manage batches sized for ease of handling and mixing proportions from entire package or packages. No On site weighing or volumetric measurements are allowed

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring applications.
   1. Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

1.7 WARRANTY

A. Work subject to the terms of the Article "Warranty of Construction" FAR clause 52.246-21.

B. Warranty: Manufacture shall furnish a single, written warranty covering the full assembly for both material and workmanship for a extended period of (3) full years from date of installation, or provide a joint and several warranty signed on a single document by manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (3) full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

1.8 APPLICABLE PUBLICATIONS

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

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

B221-08	Standard Specification for Aluminum and Aluminum-Alloy, Extruded Bars, Rods, Wire, Profiles and Tubes.
C307-03 (2008)	Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings
C413-01(2006)	Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes

C531-00(R2005)	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes
C579-01(2006)	Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
C580-02(2008)	Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
C811-98(2008)	Standard Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacings
D1308-02(2007)	Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
D2240-05	Standard Test Method for Rubber Property — Durometer Hardness
D4060-07	Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
D4226-09	Standard Test Methods for Impact Resistance of Rigid Poly (Vinyl Chloride) (PVC) Building Products
D7234-05	Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
F1869-09	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
F2170-09	Standard Test Methods for Determining Relative Humidity in Concrete Floor Slabs Using Situ Probes

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

AMP 500-06	Finishes for Aluminum

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION FOR RESINOUS FLOORING

A. System Descriptions:
   1. Basis of Design: Stonclad GR with TecTop EF, total minimum thickness of 3/16", is comprised of a penetrating two component epoxy primer, high performance, four-component mortar consisting of epoxy resin, curing agent, selected, graded aggregates blended with 30% recycled glass and inorganic pigments, a three component epoxy resin undercoat, brightly colored, decorative flake broadcast, and two-component, high performance, clear, UV light resistant epoxy sealer as manufactured and installed by Stonhard.
   2. Decorative quartz broadcast systems will not be accepted. Steel trowel finish mortars only

B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up.

C. System Components: Verify specific requirements as systems vary by manufacturer. Verify mortar base product, build up layers of broadcast systems will not be accepted. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:
   1. Primer (Bond) Coat: Verify inclusion of primer in manufacturer's system.
      a. Resin: Epoxy: Two-Component, moisture tolerant epoxy primer
      b. Formulation Description: 100% solids.
      c. Application Method: Apply by Squeegee and finish roller.
   2. Mortar (Base) Coat: Verify mortar composition.
      a. Resin: Epoxy.

b. Formulation Description: 100% solids, UV stable.
c. Application Method: Screed and steel finish trowel.
1) Thickness of coat: Verify thickness as systems vary by manufacturer; approximately from 3/16 to 1/4 inch (4.76 to 6.35 mm).
d. Aggregate: Pigmented color quartz silica aggregates integral component to mortar

3. Grout Coat: Verify inclusion of base coat in manufacturer's system.
a. Resin: Epoxy.
b. Formulation Description: 100 percent solids, UV stable.
c. Application Method: Flat squeegee and roller applied.
d. Number of coats: (2) two, wet on wet application.

4. Broadcast Flake:
a. Resin: N/A
b. Formulation description: Brightly colored decorative flake
c. Type: Multi-Color
d. Application Method: Hand
e. Finish: N/A
f. Number of coats:1

5. Top (Seal) Coat: Verify inclusion of sealer coat as systems vary by manufacturer.
a. Resin: Epoxy .
b. Formulation Description: Two-Components High UV stability, stain and mar resistant, high performance, solvent free
c. Application Method: Finish roller, dip into coating and back roll.
1) Number of coats:
d. Aggregates: White aluminum oxide, #90 grit size.
e. Type: Clear
f. Finish: Gloss

D. System Characteristics:
1. Color and Pattern: As selected by VA Resident Engineer from manufacturer's standard colors.
2. Integral cove base: 1 inch (25.4 mm) radius epoxy mortar cove keyed into concrete substrate. Verify cove base installation with manufacturer's system.
a. Stonclad GR & Tee Top EF: Height indicated on drawings at 1/8" thickness.
3. Overall System Thickness: Verify thickness as systems vary by manufacturer; between 3/16 inch (4.76 mm) and 1/4 inch (6.35 mm)
4. Finish: Textured anti-slip resistant to meet or exceed 0.06 dry; 0.08 wet.

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

Property	Test	Value
Compressive Strength	ASTM C579	7,500 psi after 7 days
Volatile Organic Compound Limits (V.O.C.)	EPA & LEED	Below 100 g/l
Tensile Strength	ASTM C307	1,750 psi
Flexural Modulus of Elasticity	ASTM C580	2,800 psi
Water Absorption	ASTM C413	0.1%
Slip Resistance Index	ASTM F1679	0.81 dry and 0.56 wet. Minimal levels
Impact Resistance	ASTM D4226	> 160 in. lbs
Abrasion Resistance	ASTM D4060 Cs-17	0.06 gm maximum weight loss

	wheel, 1000 cycles	
Thermal Coefficient of Linear Expansion	ASTM C531	1.3x 10^{-5} mm/ ºC mm
Hardness Shore D	ASTM D2240	85 to 90
Bond Strength	ASTM D7234	>300 psi 100% concrete failure
Chemical Resistance of the following: Betadyne stain resistance Acetic acid Ammonium hydroxide Citric Acid Fatty acid Motor Oil, 20W Hydrochloric acid Salt water Sodium Hydroxide Sulfuric acid Trisodium phosphate Urine Feces Hydrogen peroxide Distilled Water Sodium Hypochloride	ASTM D1380 5 percent 10 percent 50 percent 10 percent 10 percent 10 percent 5 percent 28 percent 5.28 percent	No Effect

2.2 BASE CAP STRIP

A. Aluminum, Extruded: ASTM B221, Alloy 6063-T6.

B. Shape for 5 mm (3/16 inch) depth of base material, "J" configuration.

C. Finish:
   1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
   2. Aluminum: NAAMM Amp 500:
      a. Clear anodic coating, AA-C22A41 chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
      b. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.

2.3 SUPPLEMENTAL MATERIALS

A. Textured Top Coat: Type recommended or produced by manufacturer of seamless resinous flooring system, slip resistance, type and profile of, for desired final finish.

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

C. Waterproof Membrane: Type recommended or produced by manufacturer of resinous floor coatings for type of service and conditions as indicated in Drawings and/or specified.

D. Provide a chemical resistant epoxy novolac top coat capable of resisting sustained temperatures up to 120°C (250°F).

E. Anti-Microbial Additive: Incorporate anti-microbial chemical additive to prevent growth of most bacteria, algae, fungi, mold, mildew, yeast, etc.

PART 3 - EXECUTION

3.1 INSPECTION

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

B. Moisture Vapor Emission Testing: Perform moisture vapor transmission testing in accordance with ASTM F1869 to determine the MVER of the substrate prior to commencement of the work. See section 3.4, 3.

3.2 PROJECT CONDITIONS

A. Maintain temperature of rooms (air and surface) where work occurs, between 70 and 90 degrees F (21 and 32 degrees C) for at least 48 hours, before, during, and 24 hours after installation. Maintain temperature at least 70 degrees F (21 degrees C) during cure period.

B. Maintain relative humidity less than 75 percent.

C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

D. Maintain proper ventilation of the area during application and curing time period.
   1. Comply with infection control measures of the VA Medical Center.

3.3 INSTALLATION REQUIREMENTS

A. The manufacturer's instructions for application and installation shall be reviewed with the VA Resident Engineer for the seamless resinous flooring system with integral cove base .

B. Substrate shall be approved by manufacture technical representative.

3.4 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   1. Prepare concrete substrates as follows:
      a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and re circulates the shot by vacuum pickup.
      b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
   2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
   3. Verify that concrete substrates are dry.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of [**5 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)** in 24 hours.
      b. MVT threshold for monolithic resinous Non - climatic flooring shall not exceed 5 lbs/1000 square feet (0.0001437 kPa) in a 24 hour period. MVT threshold for monolithic resinous climatic flooring shall not exceed 6 lbs/1000 square feet (0.0002155 kPa) over a 24 hour period.

c. When MVT emission exceeds this limit, apply manufacturer's recommended vapor control primer or other corrective measures as recommended by manufacturer prior to application of flooring or membrane systems.
d. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75-80 percent.
e. Provide a written report showing test placement and results.

4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for flooring manufacturer recommended joint fill material, and concrete crack treatment.

F. Prepare wall to receive integral cove base :
1. Verify wall material is acceptable for resinous flooring application, if not, install material (e.g. cement board) to receive base.
2. Fill voids in wall surface to receive base, install undercoats (e.g. water proofing membrane, and/or crack isolation membrane) as recommended by resinous flooring manufacturer.
3. Install base / prior to flooring if required by resinous flooring manufacturer.
4. Grind, cut or sand protrusions to receive base application.

3.5 APPLICATION

A. **General**: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum inter-coat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply Primer: over prepared substrate at manufacturer's recommended spreading rate.

C. Apply cove base: Trowel to wall surfaces at a 1 inch radius, before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, and troweling, sanding, and top coating of cove base. Round internal and external corners.

D. Trowel mortar base: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using a specially designed screed box adjusted to manufacturer's recommended height. Metal trowel hand or plastic blade power trowel, single mortar coat in thickness indicated for flooring system, Pre fill or grout to fill substrate voids. When cured, scrape or lightly stone mortar base to remove left unbounded material.

E. Grout coat: Mix and roller apply the grout coats with strict adherence to manufacturer's installation procedures and coverage rates. (2) Two grout coatings to insure uniform coverage with wet on wet application.

F. Broadcast: Immediately broadcast decorative flaks into the undercoat. Adhere to amnufacturer's installation procedures & coverage rates.

G. Topcoat (sealer): Remove excess unbounded flakes by lightly sanding & vacuuming the floor surface. Mix and roller apply the topcoat(s) with strict adherence to manufacturer's installation procedures and coverage rates. Apply aluminum oxide aggregate with strict adherence to manufacturer's installation procedures.

3.6 TOLERANCE

A. From line of plane: Maximum 1/8 inch (3.18 mm) in total distance of flooring and base.

B. From radius of cove: Maximum of 1/8 inch (3.18 mm) plus or 1/16-inch (1.59 mm) minus.

3.7 CURING, PROTECTION AND CLEANING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process.

B. Close area of application for a minimum of 24 hours.

C. Protect resinous flooring materials from damage and wear during construction operation.
   1. Cover flooring with kraft type paper.
   2. Optional 6 mm (1/4 inch) thick hardboard, plywood, or particle board where area is in foot or vehicle traffic pattern, rolling or fixed scaffolding and overhead work occurs.

D. Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

SECTION 09 67 23.60
RESINOUS (URETHANE FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies Resinous (Resinous urethane and epoxy mortars) flooring with integral cove base, and trench or pit liner:
   1. High Abuse Climatic Troweled and Sealed Urethane Mortar Flooring System.

1.2 RELATED WORK

A. Concrete and Moisture Vapor Barrier: Section 03 30 00, CAST-IN-PLACE CONCRETE.

B. Color and location of each type of resinous (urethane mortar) flooring: As indicated in Section 09 06 00, SCHEDULE FOR FINISHES.

C. Floor Drains: Division 22, PLUMBING.

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data:
   1. Description of each product to be provided.
   2. Application and installation instructions.
   3. Maintenance Instructions: Submit manufacturer’s written instructions for recommended maintenance practices.

C. Qualification Data: For Installer.

D. Samples:
   1. Each color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.
   2. Samples for verification: For each (color and texture) resinous flooring system required, 6 inches (152 mm) square, applied to a rigid backing by installer for this project.
   3. Sample showing construction from substrate to finish surface in thickness specified and color and texture of finished surfaces. Finished flooring must match the approved samples in color and texture.

E. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:
   1. Patterns.
   2. Edge configurations.

F. Certifications and Approvals:
   1. Manufacturer's certification of material and substrate compliance with specification.
   2. Manufacturer's approval of installers.
   3. Contractor's certificate of compliance with Quality Assurance requirements.

G. Warranty: As specified in this section.

1.4 QUALITY ASSURANCE

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

B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this project for a minimum period of five (5) years, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
   1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
   2. Contractor shall have completed at least five (5) projects of similar size and complexity. Include list of at least five (5) projects. List must include owner (purchaser); address of installation, contact information at installation project site; and date of installation.
   3. Installer's Personnel: Employ persons trained for application of specified product.

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

D. Pre-Installation Conference:
   1. Convene a meeting not less than thirty days prior to starting work.
   2. Attendance:
      a. Contractor
      b. VA Resident Engineer
      c. Manufacturer and Installer's Representative
   3. Review the following:
      a. Environmental requirements
         1) Air and surface temperature
         2) Relative humidity
         3) Ventilation
         4) Dust and contaminates
      b. Protection of surfaces not scheduled to be coated
      c. Inspect and discus condition of substrate and other preparatory work performed
      d. Review and verify availability of material; installer’s personnel, equipment needed
      e. Design and edge conditions.
      f. Performance of the coating with chemicals anticipated in the area receiving the resinous (urethane mortar/cement) flooring system
      g. Application and repair
      h. Field quality control
      i. Cleaning
      j. Protection of coating systems
      k. One-year inspection and maintenance
      l. Coordination with other work

E. Manufacturer’s Field Services: Manufacturer’s representative shall provide technical assistance and guidance for surface preparation and application of resinous flooring systems.

F. Contractor Job Site Log: Contractor shall document daily; the work accomplished environmental conditions and any other condition event significant to the long term performance of the urethane and epoxy mortar/cement flooring materials installation. The Contractor shall maintain these records for one year after Substantial Completion.

G. Volatile Organic Compound content to remain under 100g/liter.

1.5 MATERIAL PACKAGING DELIVERY AND STORAGE

A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.

B. Protect materials from damage and contamination in storage or delivery, including moisture, heat, cold, direct sunlight, etc.

C. Maintain temperature of storage area between 60 and 80 degrees F (15 and 26 degrees C).

D. Keep containers sealed until ready for use.

E. Do not use materials beyond manufacturer's shelf life limits.

F. Package materials in factory pre-weighed and in single, easy to manage batches sized for ease of handling and mixing proportions from entire package or packages. No On site weighing or volumetric measurements are allowed.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring applications.
   1. Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

1.7 WARRANTY

A. Work subject to the terms of the Article "Warranty of Construction" FAR clause 52.246-21.

B. Warranty: Manufacture shall furnish a single, written warranty covering the full assembly (including substrata) for both material and workmanship for a extended period of three (3) full years from date of installation, or provide a joint and several warranty signed on a single document by manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of three (3) full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

1.8 APPLICABLE PUBLICATIONS

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

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

B221-08	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
C307-03 (2008)	Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings

C413-01(2006)	Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes
C531-00(2005)	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
C579-01(2006)	Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
C580-02(2008)	Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
C811-98(2008)	Standard Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacings
D1308-02(2007)	Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
D2047-04	Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
D2240-05	Standard Test Method for Rubber Property — Durometer Hardness
D4060-07	Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
D4226-09	Standard Test Methods for Impact Resistance of Rigid Poly(Vinyl Chloride) (PVC) Building Products
D7234-05	Standard Test Methods for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
F1869-09	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
F2170-09	Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

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

AMP 501	Finishes for Aluminum

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION FOR RES-6A (HEAVY DUTY CLIMATIC)

A. System Descriptions:
   1. Basis of Design: Stonclad UR with Stonclad UT Sealer, total minimum thickness of 3/16", is comprised of a penetrating three component urethane primer, high performance, four-component mortar consisting of urethane resin, curing agent, selected, graded aggregates blended with inorganic pigments, a two-component, high performance, pigmented urethane sealer as manufactured and installed by Stonhard.

B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up.

C. System Components: Verify specific requirements as systems vary by manufacturer. Verify mortar base product, build up layers of broadcast systems will not be accepted. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:
   1. Urethane Primer:
      a. Three-Component Urethane primer
   2. Mortar (Body coat):
      a. Resin: Urethane or Polyurethane
      b. Formulation Description: Multiple component high solids.

c. Application Method: Screed and steel finish trowel.
d. Thickness of coat(s): Verify thickness as systems vary by manufacturer; Nominal thickness 3/16 to 1/4 inch (4.76 to 6.35mm).
e. Number of Coats: One.
f. Aggregates: Quartz texture broadcast into wet urethane mortar base.

3. Seal Coat(s):
   a. Resin: Urethane.
   b. Formulation Description: Pigmented Two-component, high solids.
   c. Application Method: Squeegee and Back roll.
   d. Number of Coats: One.
   e. Finish Gloss

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

Property	Test	Value
Compressive Strength	ASTM C579	5,000 psi after 7 days
Tensile Strength	ASTM C307	1,000 psi
Flexural Strength	ASTM C580	2,400 psi
Water Absorption	ASTM C413	0.056%
Coefficient of friction dry/slip index wet	ASTM D2047	>1.0 dry >1.0 wet
Impact Resistance	ASTM D4226	> 160 in. lbs
Abrasion Resistance	ASTM D4060	0.05 gm maximum weight loss
Thermal Coefficient of Linear Expansion	ASTM C531	1.1×10^{-5} mm/ ºC mm
Hardness Shore D	ASTM D2240	80 to 84
Bond Strength	ASTM D7234	>300 psi 100% concrete failure
Chemical Resistance of the following:	ASTM D1308	No Effect
Acetic acid	5 percent	
Ammonium hydroxide	10 percent	
Citric Acid	50 percent	
Fatty acid Motor Oil, 20W		
Hydrochloric acid	10 percent	
Salt water	10 percent	
Sodium Hydroxide	10 percent	
Sulfuric acid	5 percent	
Trisodium phosphate		
Urine		
Feces		
Hydrogen peroxide	28 percent	
Distilled Water		
Sodium Hypochloride	5.28 percent	

2.2 SUPPLEMENTAL MATERIALS

A. Textured Top Coat: Type recommended or produced by manufacturer of seamless resinous flooring system, slip resistance, type and profile for desired final finish.

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

C. Waterproof Membrane: Type recommended or produced by manufacturer of resinous floor coatings for type of service and conditions as indicated in Drawings and/or specified .

D. Provide a chemical resistant epoxy novolac top coat capable of resisting sustained temperatures up to 120°C (250°F).

E. Crack Isolation Membrane: Type recommended or produced by manufacturer of resinous flooring for conditions as indicated in Drawings and/or specified.

F. Anti-Microbial Additive: Incorporate anti-microbial chemical additive to prevent growth of most bacteria, algae, fungi, mold, mildew, yeast, etc.

2.3 TROWELED COVE BASE

A. Same physical properties as specified resinous mortar system. climatic, .

2.4 BASE CAP STRIP

A. Aluminum, Extruded: ASTM B221, Alloy 6063-T6.

B. Shape for 3/16 inch (4.76 mm) depth of base material, "J" configuration.

C. 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 (0.018 mm) or thicker.

PART 3 - EXECUTION

3.1 INSPECTION

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

B. Moisture Vapor Emission Testing: Perform moisture vapor transmission testing in accordance with ASTM F1869 to determine the MVER of the substrate prior to commencement of the work. See section 3.4, 3.

3.2 PROJECT CONDITIONS

A. Maintain temperature of rooms (air and surface) where work occurs, between 70 and 90 degrees F (21 and 32 degrees C) for at least 48 hours, before, during, and 24 hours after installation. Maintain temperature at least 70 degrees F (21 degrees C) during cure period.

B. Maintain relative humidity less than 75 percent.

C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

D. Maintain proper ventilation of the area during application and curing time period.
   1. Comply with infection control measures of the VA Medical Center.

3.3 INSTALLATION REQUIREMENTS

A. The manufacturer's instructions for application and installation shall be reviewed with the VA Resident Engineer for the seamless resinous (urethane mortar) flooring system with integral cove base .

B. Substrate shall be approved by manufacture technical representative.

3.4 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   1. Prepare concrete substrates as follows:
      a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and re circulates the shot by vacuum pickup.
      b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent. Use of acids is never allowed.
   2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
   3. Verify that concrete substrates are dry.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 5 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. MVT threshold for monolithic resinous Non - climatic flooring shall not exceed 5 lbs/1000 square feet (0.0001437 kPa) in a 24 hour period. MVT threshold for monolithic resinous climatic flooring shall not exceed 6 lbs/1000 square feet (0.0002155 kPa) over a 24 hour period.
      c. When MVT emission exceeds this limit, apply manufacturer’s recommended vapor control primer or other corrective measures as recommended by manufacturer prior to application of flooring or membrane systems.
      d. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75-80 percent.
      e. Provide a written report showing test placement and results.
   4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for flooring manufacturer recommended joint fill material, and concrete crack treatment.

F. Prepare wall to receive integral cove base:
   1. Verify wall material is acceptable for resinous flooring application, if not, install material (e.g. cement board) to receive base.

2. Fill voids in wall surface to receive base, install undercoats (e.g. water proofing membrane, and/or crack isolation membrane) as recommended by resinous flooring manufacturer.
3. Install base prior to flooring if required by resinous flooring manufacturer.
4. Grind, cut or sand protrusions to receive base application.

3.5 APPLICATION

A. **General**: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
      a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply Primer: over prepared substrate at manufacturer's recommended spreading rate.

C. Apply cove base: Trowel to wall surfaces at a 1 inch radius, before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, and troweling, sanding, and top coating of cove base. Round internal and external corners.

D. Trowel mortar base: Mix mortar material according to manufacturer's recommended procedures. Climatic resinous flooring systems may vary slightly on mode of application. Application should be based upon the following: Uniformly spread mortar over substrate using a specially designed screed box adjusted to manufacturer's recommended height. Metal trowel (hand or power) single mortar coat in thickness indicated for flooring system, grout to fill substrate voids. When cured, sand to remove trowel marks and roughness

E. Topcoat: Mix and roller apply the topcoat(s) with strict adherence to manufacturer's installation procedures and coverage rates.

3.6 TOLERANCE

A. From line of plane: Maximum 1/8 inch (3.18 mm) in total distance of flooring and base.

B. From radius of cove: Maximum of 1/8 inch (3.18 mm) plus or 1/16-inch (1.59 mm) minus.

3.7 CURING, PROTECTION AND CLEANING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process.

B. Close area of application for a minimum of 24 hours.

C. Protect resinous flooring materials from damage and wear during construction operation.
   1. Cover flooring with kraft type paper.
   2. Optional 6 mm (1/4 inch) thick hardboard, plywood, or particle board where area is in foot or vehicle traffic pattern, rolling or fixed scaffolding and overhead work occurs.

D. Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

SECTION 09 67 81.01
CONCRETE FLOOR SEALER (CFS-ND)

PART 1 - GENERAL

1.1 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.2 QUALITY ASSURANCE

A. Applicator must be a licensee of manufacturer, or approved in writing.

1.3 SUBMITTALS

A. Project Information:
   1. Maintenance data.
   2. Warranty.

1.4 JOB CONDITIONS

A. Install only when surface and ambient temperatures are between 45 and 85 deg F (.

B. Install prior to other finishes.

C. Provide adequate ventilation during installation.

D. Take proper precautions for use of flammable materials.

1.5 WARRANTY

A. Written warranty signed jointly by applicator and manufacturer.

B. Manufacturer's standard warranty for material performance.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable manufacturers:
   1. Concrete Floor Sealer – Normal Duty (CFS-ND):
      a. Base:
         1) L&M Construction Chemicals.
      b. Optional:
         1) BASF Construction Chemicals.
         2) Dayton Superior
   2. Or Approved Equal.

B. Concrete Floor Sealer – Normal Duty (CFS-ND):
   1. Water-based, low VOC, acrylic copolymer solutions that cure, seal and dustproof concrete with minimal yellowing.
   2. Conform to ASTM-C1315, Type I, Class B, be VOC compliant, and meet all local air quality regulations.

3. Federal Spec: TT-C-800A.
4. Minimum Solids Content: 30% by volume.
5. Primer: As recommended by manufacturer.
6. Base Product:
   a. “Dress & Seal WB 30” by L&M.
   b. “Dress & Seal 30” by L&M.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

A. Verify that concrete was steel troweled and hair broomed and is free of fins, ridges or voids.

B. Assure that curing agents used are compatible with coating system or completely removed.

C. Concrete must be cured for minimum of 28 days, with moisture content not exceeding 8 percent.

D. Remove surface contamination by cleaning or if necessary by sandblasting.

E. Patch holes or voids.

F. Rout out cracks exceeding 1/16 IN wide and calk.

G. Calk non-moving joints up to 1 IN wide with suitable backer and sealant.

H. Do not calk or overcoat joints where movement exceeds 25% or joints over 1 IN wide.

I. These joints must receive other joint treatment to assure watertightness.

J. Install test patch.

K. If test patch indicates lack of adhesion, install primer.

3.3 INSTALLATION

A. DO NOT apply to surfaces scheduled to subsequently receive cementitious coatings or toppings, such as concrete, terrazzo, polyester or epoxy coatings.

B. Apply by airless spray, long handled roller or brush.

C. Apply in accordance with manufacturer's recommendations; minimum 2 coats.

D. Apply first coat at not over 400 SF/GAL.

E. Apply subsequent coat at a coverage rate not over 400 SF/GAL.

F. Allow no traffic on sealed surface for 72 hours after application.

3.4 PATCHING AND CLEANING

A. Patch areas which fail to match adjacent work.

B. Clean surface "broom clean" after completion of work.

C. Remove debris resulting from these operations.

END OF SECTION

SECTION 09 68 13.01
CARPET TILE

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. General requirements:
   1. Manufacturer:
      a. Carpet manufacturer shall have no less than 10 years of production experience with carpet similar to type specified in this document; and whose published product literature clearly indicate compliance of products with requirements of this section.
      b. Single source responsibility: Provide product material by a single manufacturer for each carpet type specified.
   2. Trade Contractor: Firm with not less than five (5) years of successful carpeting experience similar to work of this section and recommended and approved by the carpet manufacturer. Upon request, submit letter from carpet manufacturer stating certification qualifications and acceptance.
   3. Substitutions: Where a selected manufacturer or product has been specified, an equal or superior product may be accepted only upon review and written acceptance by the Architect. It is mandatory that such review and approval be obtained prior to bidding, or the substitution will not be considered. All such proposed substitutions shall be submitted to the architect with all appropriate manufacturer's specifications and literature, and independent testing laboratory data. The architect's decision as to whether a product is equal or superior to the one specified shall be final. This section applies to any "or equal" noted in the specifications.
   4. Installer qualifications: Mill trained, skilled mechanics supervised by experienced superintendent with 50,000 yards experience.

1.2 SUBMITTALS

A. Samples:
   1. Three samples, minimum 12 IN x 12 IN of each material and color selected for verification.

B. Contract Closeout Information:
   1. Warranty/Guarantee.
   2. Letter stating extra material has been delivered.
   3. Maintenance data.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver with mill register numbers attached.

B. Tag and mark accessory items for identification.

C. Store Carpet and related materials in a climate-controlled, dry space.
   1. Protect Carpet from soil, dust, moisture and other contaminants.
   2. Store on a flat surface.
   3. Do not stacking heavy objects on top of carpet packages.

1.4 JOB CONDITIONS

A. Install after wall and other floor finishing operations in area are complete.

B. Install after lighting system in area is complete.

C. Install prior to acoustical ceiling tile.

D. Maintain temperature of 65-95 DegF for not less than 48 hours prior to installation.
   1. Do not allow relative humidity to exceed 65%.
   2. Maintain same temperature and RH conditions throughout installation.

1.5 WARRANTY/GUARANTEE

A. Guarantee entire carpet installation complies with specifications, and damaged or defective carpet or carpet stained by adhesives will be removed and replaced for a period of 2 years.

B. Guarantee carpet color consisting of thermally pigmented yarns will not show significant change when exposed to normal light for period of 15 years.
   1. AATCC-16E.

C. Guarantee carpet color will not show significant change when exposed to normal atmospheric contaminates for period of 15 years.

D. Guarantee carpet will not show excessive wear for period of 15 years.
   1. Excessive wear is defined as wearing away of face yarns which reduces pile height by more than 15 percent in any area or pulling out of nap.

E. Guarantee carpet backing structure will not delaminate from face structure and there will be no shrinkage or stretching affecting performance of face or backing structure for period of 15 years when installed and maintained in accordance with published procedures.
   1. Guarantee when installed and maintained in accordance with published procedures will not edge ravel for a period of 15 years.
   2. Guarantee ability of the carpet to lay flat; will not curl or dome.

F. Guarantee entire cost of replacement, including removal, replacement, and disposal of defective carpet.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable manufacturers:
   1. Carpet Tile (CPT):
      a. Base:
         1) Shaw contract group.
   2. Carpet Edging Strips:
      a. Base:
         1) BurkeMercer.
   3. Or Approved Equal.

B. Carpet Tile (CPT):
   1. First quality, no seconds or imperfects.
   2. Comply with applicable state and local codes.

C. Carpet Edging Strips:
   1. Base Product: “Carpet to Resilient Transition 170” by Burke Mercer.
   2. Thickness to match carpet.
   3. Color as selected by Architect.

D. Water vapor emission control system: See Section 09 60 05.

E. Adhesive:
   1. Non-staining, non-bleeding strippable type.
   2. As recommended by carpet manufacturer.

2.2 CARPET TYPES

A. Carpet:
   1. Manufacturer: Shaw Contract Group.
   2. Style: Catalyst Tile.
   3. Color: Dapple #64761.

2.4 EXTRA MATERIAL

A. Furnish Owner with minimum of 5 percent additional material of each type, pattern and color for maintenance purposes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrate to accept installation.

B. Concrete preparation for floor finishes: See Section 09 60 05.

C. Verify concrete is sealed. New concrete requires approximately 90 days to cure.

D. Repair or patch existing vinyl composition tile.
   1. Remove old wax.
   2. Seal cut-back exposed adhesive.

E. Sand wood finish on subfloor repair loose or broken boards and other defects.

F. Patch or fill cracks and irregularities on granolithic terrazzo marble ceramic subfloors.
   1. Fill grout lines with approved latex patching compound.

3.2 PREPARATION

A. Thoroughly clean areas to receive carpet tile, seal new concrete, strip waxes and finishes.

B. Thoroughly remove dust and vacuum, also wet mop then seal concrete.

C. Fill cracks, joints, holes or uneven areas with non-crumbling latex base floor filler such as Lev-L-Astic, patching compound must be mixed with latex mix not water.

D. Before commencing work, test an area with glue and carpet tile to determine "open-time" and bond.

E. Layout:
   1. Arrange joints symmetrically about centerline of rooms.
   2. Lay so pile and pattern of adjacent pieces match.
   3. Carefully check dimensions.

3.3 INSTALLATION

A. General:
   1. Comply with manufacturer's instructions and recommendations for uniformity of direction, seam locations, and lay of carpet pile.
   2. Place tile with sight butted joints.

3. Install carpet under open-bottom obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.
4. Provide cut outs where required.
   a. Conceal cut edges with protective edge guards or overlapping flanges.
5. Run carpet under open-bottom items such as heating convectors and install tight against walls, columns and cabinets so entire floor area is covered with carpet.
   a. Cover over all floor type door closers.
6. Install edging guard at all openings and doors wherever carpet terminates, unless indicated otherwise.
   a. Prior to installation, report to the Construction Manager all other obstructions which may occur.
7. Cutting shall be done in accordance with the manufacturer's recommendation, using the tools designed for the carpet being installed, making sure carpet knives are sharp.
8. Edges shall be butted together with the proper pressure to produce the tightest joint possible without distortion.
9. All carpet shall be installed with pile-lay in the same direction.
10. Use leveling compound where necessary.
    a. Any floor filling or leveling shall have a minimum of 4 FT- 0 IN of feather.
11. Expansion joints:
    a. Do not bridge building expansion joints with continuous carpeting.
    b. Provide for movements.

B. Install in accordance with manufacturer's instructions.
   1. Follow instructions on adhesives.
      a. Adhesive must have recommended flash time before carpet is positioned.
   2. Do not mix dye lots in the same area.
   3. Install all carpet tiles so arrows point in the same direction.

C. Where carpet terminates at non-carpeted floor surface, install Carpet Edging Strips (a.k.a. transition strips, reducer strips).
   1. Install with contact adhesive.
   2. Score and trim narrow end of reducer strip to conform to adjacent floor finish.

D. Install according to Architect's directions for overall patterns and borders.
   1. Install carpet patterns according to drawings with no deviation.
   2. Develop templates as necessary.

3.4 CLEAN

A. Remove spillage of glue or adhesive from face or seam using remover provided by manufacturer.

B. Clean spots; remove loose threads with broadloom scissors.

C. Completely and thoroughly vacuum using a pile lifter.

D. Advise maintenance personnel regarding care and maintenance.

E. Save cuts over 9 IN for Owner stock.

3.5 PROTECTION

A. After cleaning and prior to final acceptance, protect carpeting subject to traffic with nonstaining building material paper runners or other approved material.

B. Protect installation from rolling traffic by using sheets of hardboard or plywood in potentially affected areas.

C. Protect carpeting against damage during construction:
   1. Cover with nonstaining building material paper with taped joints during the construction period, wherever protection is required, so carpet will be without any indication of deterioration, wear, or damage at the time of acceptance.
   2. Damaged carpeting will be rejected.
   3. As the carpet is laid, remove trimmings, excess pieces of carpet and laying materials from each area as it is completed.

D. Maintain protection of carpeting on each floor or area until accepted, without waiting until the entire project is complete.

3.6 INSPECTION

A. Upon completion of the installation inspect installation and verify work is complete, properly installed, and acceptable.

B. Remove and replace work not found acceptable at the installers expense.

END OF SECTION

SECTION 09 72 00.01
WALL COVERINGS
(HYGIENIC VINYL WALL COVERING)

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes labor, materials and other services necessary to complete vinyl wall coverings.

B. Conform with requirements of all Sections of Division 1, General Requirements, as it applies to the work of this Section.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete finishing.

B. Division 7 - Thermal and Moisture Protection.

C. Division 15 - Mechanical.

1.3 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. American Society for Testing & Materials (ASTM):
   1. AST ASTM E 84-05 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide hygienic wall covering which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's current printed product literature, specifications, installation instructions, and field reports in accordance with Section 01 33 00 - Submittal Procedures.

B. Shop Drawings: Submit shop drawings to indicate materials, details, and accessories in accordance with Section 01 33 00 - Submittal Procedures including but limited to the following:
   1. 1. Submit a layout diagram indicating the location of each panel and joining method.

C. Samples: Submit duplicate sample pieces of wall panel material, as well as accessory pieces in accordance with Section 01 33 00 - Submittal Procedures.

D. Quality Assurance Submittals: Submit the following:
   1. 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
   2. 2. Manufacturer's Instructions: Current published manufacturer's installation and maintenance instructions.

3. 3. Manufacturer's Field Reports: Specified herein.

E. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
   2. Warranty: Warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
   1. Training: Installer who has attended the manufacturer's installation training clinic.

B. Mock-ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.
   1. Mock-Up Size: In Place .
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required, if not part of final construction.
   3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

C. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.7 DELIVERY, STORAGE & HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Deliver, store and handle wall panels in accordance with Section 01 00 00 – General .

C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

E. Store panels in temperature controlled environments. Leave protective blue film on panel until ready to use.

1.8 WASTE MANAGEMENT AND DISPOSAL

A. Deposit all packaging materials in appropriate container on site for recycling or reuse.

B. Avoid using landfill waste disposal procedures when recycling facilities are available.

C. Keep all discarded packaging away from children.

1.9 PROJECT CONDITIONS

A. Temperature Requirements: If storage temperature is below 65F (18C), the wall panel must be moved to a warmer place and allowed to reach this temperature before installation. For further information, refer to current Installation Guide.

B. Maintain air temperature and structural base temperature at installation area between 65F (18C) and 80F (26C) for 48 hours before, during and 24 hours after installation.

1.10 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

C. Warranty Period shall be 10 years commencing on Date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Provide extra materials of product and adhesives in accordance with Section 01780 - Closeout Submittals.

B. Provide [32]sqft of each color, pattern and type material required for project for maintenance use.

C. Provide [32]sqft of extra materials in one piece and from same production run as installed materials.

D. Clearly identify each wall panel and each container of adhesive.

E. Deliver to Consultant, upon completion of the work of this section and store where directed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: (Basis of Design) Altro
Altro Whiterock as supplied by Compass Flooring, Inc.
A division of Altro Floors LTD.
12648 Clark Street- Santa Fe Springs, California 90670- (800)-543-6033
Pete Andrea (925) 708-5425

2.2 HYGIENIC WALL COVERINGS

A. Altro Whiterock hygienic vinyl wall covering

B. Or approved equal

2.3 ACCESSORIES

A. Vinyl welding rod: Acceptable material:
1. Altro weld rod

B. Joint Strips:
1. 1-Part Joint Strip – [G831/25 White] Length 98.5"
2. 1-Part Joint Strip – [G831/30 White] Length 118"
3. 2-Part Joint Strip – [A831/25 White] [A831/25/* Colors] Length 98.5"
4. 2-Part Joint Strip – [A831/30 White] [A831/30/* Colors] Length 118"
5. Or equal & as recommended by wall panel manufacturer

C. Cut-Tile Transition Strips:
1. 1-Part Transition Strip – [G832/25 White] Length 98.5"
2. 2-Part Joint Strip – [A832/25 White] [G831/30/* Colors] Length 98.5""
3. C4 CAP Strip – [C4 CAP White] Length 72"
4. Or equal & as recommended by wall panel MFR

D. Start and Edge Trim:
   1. 1-Part Start and Edge Trim – [G833/25 White] Length 98.5”
   2. 1-Part Start and Edge Trim – [G833/30 White] Length 118”
   3. 2-Part Start and Edge Trim – [A833/25 White] [A833/25/* Colors] Length 98.5”
   4. 2-Part Start and Edge Trim – [A833/30 White] [A833/30/* Colors] Length 118”
   5. Or equal & as rec. by wall panel MFR

E. Stainless Steel Accessories:
   1. Stainless Steel Corner Protector – [A861/12 Brushed Steel] Dimensions: 4” x 2 ½ x 2 ½”
   2. 1-Part Stainless Steel Joint Strip – [A855 Brushed Steel] Length 7’
   3. Stainless Steel Capping – [A865 Brushed Steel] Length 8’
   4. 18 Gauge Stainless Steel 304 Sheet – [W123/20 Brushed Steel] 6’6” X3’3”
   5. 18 Gauge Stainless Steel 304 Sheet – [W123/25 Brushed Steel] 8’2” X4’
   6. Or equal & as Rec by wall panel MFR

F. Acrylic Adhesive: For dry, climate controlled areas, use AltroFix W49 (or equal), a one-part, water-based, acrylic adhesive as recommended by manufacturer.

G. Polyurethane Adhesive: The default adhesive for most installations, suitable for wet area, non-climate controlled areas, and non-absorbent surfaces, use AltroFix W39, a two-part resin-based polyurethane adhesive as recommended by manufacturer.

H. Caulking and Mastic Compounds and Tools:
   1. FlexiJoint Coil – [FJ101/white] [FJ* Colors] Length 164 linear feet
   2. FlexiJoint Steel Spacers (engineered steel)
   3. Parabond Mastic – [AP600] 10 oz
   4. Altro Mastic Caulking – [A802 White/A803 Clear/A806* Colors) 10.5 oz
   5. Or equal & as recommended by wall panel manufacturer

2.4 SOURCE QUALITY

A. Source Quality: Obtain wall products from a single manufacturer.

PART 3 - EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

A. Compliance: Comply with manufacturer’s product data, including product technical bulletins, product catalog, installation instructions and product label instructions for installation.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.

3.3 SUBSTRATE PREPARATION

A. Walls should be smooth and level. High points must be removed and low points filled with filler intended for the substrate and environmental conditions.

B. Wall tiles must be fixed firmly to the wall. As long as the tile edges do not protrude you do not have to skim grout joints.

C. Surfaces must be permanently dry and free from all substances that may contribute to adhesive bond failure.

D. Remove loose paint and conduct an adhesive bond test with paint.

E. Exterior walls must be adequately damp-proofed and insulated.

F. Dry wall substrates should be paint ready.

3.4 PREPARATION

A. All surfaces must be free from dust and cleaned prior to wall panel installation. The working environment must also be dust free. Failure to comply with these conditions will reduce the bond strength between the adhesive and substrate, and may cause the Whiterock panels to debond.

B. Very absorbent / porous substrates (particularly plaster finishes and unprimed sheetrock) must have a proprietary sealer e.g. PVA primer or similar, applied to the surface a minimum of 12 hours prior to the installation.

C. All electrical switches, power points etc., should be in a first fix / installation state. All electrical equipment should only be moved or altered by a qualified electrician.

D. All plumbing should have pipe-work removed to a first fix or installation state and "tails" left protruding from the substrate. Wall panels can then be drilled and slid over the pipe tails. All holes should be drilled 1/8" (3mm) oversize to allow for expansion, then sealed with AltroMastic (or equal) caulking. Plumbing should always be done by a qualified plumber.

E. Hot pipes and steam pipes should be insulated and a 1/8" to 1/4" (3-6mm) expansion gap should be created when installing panels around these pipes, then sealed with AltroMastic (or equal) caulking.

F. All pipes, fixing bolts, etc. extending through the Whiterock panels should have a minimum 1/8" (3mm) expansion gap and be sealed using AltroMastic (or equal) caulking.

G. If fitting to door frames, these must be in place prior to installation of panels .

H. Prior to installation, it is advisable to complete any painting which comes in contact with wall panels , as sealant used at junctions is non-paintable.

I. Panels should be stored flat and be pre-conditioned a minimum of 24 hours in ambient temperatures similar to the prevailing operational conditions.

J. The panels must be stored on a level flat surface off the ground (risk of condensation on the panels if stored on damp surfaces). Storage on uneven surfaces could cause the panels to distort prior to installation.

K. First, check the room using a 6' (2 m) level to ensure all walls are flat, paying particular attention to the corners, window reveals, and door entrances. These need to be inspected to ensure they are free of any debris or irregularities, which could prevent the panels laying flat to the substrate after the adhesive has been applied and the panel installed.

3.5 INSTALLATION

A. Hygienic Wall Installation: Install panels in accordance with the current published Altro Installation Guide. All joints should be joined by approved methods as detailed in the installation guide. Failure to install panels in accordance with recommended procedures will void the Altro Limited Product Warranty.

3.6 FIELD QUALITY REQUIREMENTS

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

1. Site Visits: When walls are ready for panel installation, after a section has been completed (mock-up), when installation is complete.

3.7 CLEANING

A. Altro Whiterock can be cleaned with a diluted soap/detergent solution, such as Altro 44 Cleaner.

B. When cleaning the Whiterock surface, we recommend the temperature of water does not exceed 140° F (60° C).

C. Pressure cleaning with hot water may be used with the pressure nozzle a minimum of 2 feet (600mm) away from the surface.

D. To reduce the buildup of static, cleaning the panels with an anti-static solution is recommended.

E. Stubborn stains use AltroClean 44 cleaner or equivalent alkaline cleaner.
   1. Remove construction debris from project site and legally dispose of debris.

3.8 PROTECTION

A. Do not install near open heat sources (ovens, etc). Stainless steel panels should be used in such areas.

END OF SECTION

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. Glazed wall surfacing or tile like coatings: Section 09 96 59, HIGH-BUILD GLAZED COATINGS.

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. Attach labels to panel stating the following:
      a. Federal Specification Number or manufacturers name and product number of paints used.
      b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
      c. Product type and color.

d. Name of project.

4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

D. Sample of identity markers if used.

E. Manufacturers' Certificates indicating compliance with specified requirements:
1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.
4. 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, , apply paint as specified to an area, not to exceed 9 m^2 (100 ft^2), selected by Resident Engineer.

B. Finish and texture approved by Resident Engineer 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-2008	Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
ACGIH TLV-DOC-2008	Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. American National Standards Institute (ANSI):
A13.1-07 Scheme for the Identification of Piping Systems

D. American Society for Testing and Materials (ASTM):
D260-86 Boiled Linseed Oil

E. Commercial Item Description (CID):
A-A-1555 Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)

A-A-3120 Paint, For Swimming Pools (RF) (cancelled)

F. Federal Specifications (Fed Spec):
TT-P-1411A Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):
No. 1-07 Aluminum Paint (AP)
No. 8-07 Exterior Alkyd, Flat MPI Gloss Level 1 (EO)
No. 9-07 Exterior Alkyd Enamel MPI Gloss Level 6 (EO)
No. 10-07 Exterior Latex, Flat (AE)
No. 11-07 Exterior Latex, Semi-Gloss (AE)
No. 26-07 Cementitious Galvanized Metal Primer
No. 31-07 Polyurethane, Moisture Cured, Clear Gloss (PV)
No. 43-07 Interior Satin Latex, MPI Gloss Level 4
No. 44-07 Interior Low Sheen Latex, MPI Gloss Level 2
No. 45-07 Interior Primer Sealer
No. 46-07 Interior Enamel Undercoat
No. 47-07 Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
No. 48-07 Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
No. 49-07 Interior Alkyd, Flat, MPI Gloss Level 1 (AK)
No. 50-07 Interior Latex Primer Sealer
No. 51-07 Interior Alkyd, Eggshell, MPI Gloss Level 3
No. 52-07 Interior Latex, MPI Gloss Level 3 (LE)
No. 53-07 Interior Latex, Flat, MPI Gloss Level 1 (LE)
No. 54-07 Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
No. 77-07 Epoxy Cold Cured, Gloss (EC)
No. 79-07 Marine Alkyd Metal Primer
No. 94-07 Exterior Alkyd, Semi-Gloss (EO)
No. 95-07 Fast Drying Metal Primer
No. 98-07 High Build Epoxy Coating
No. 101-07 Epoxy Anti-Corrosive Metal Primer
No. 108-07 High Build Epoxy Coating, Low Gloss (EC)
No. 114-07 Interior Latex, Gloss (LE) and (LG)
No. 117-07 Bonding Primer, Water-Based
No. 119-07 Exterior Latex, High Gloss (acrylic) (AE)
No. 135-07 Non-Cementitious Galvanized Primer
No. 138-07 Interior High Performance Latex, MPI Gloss Level 2 (LF)
No. 139-07 Interior High Performance Latex, MPI Gloss Level 3 (LL)
No. 140-07 Interior High Performance Latex, MPI Gloss Level 4
No. 141-07 Interior High Performance Latex (SG) MPI Gloss Level 5
No. 151-07 Interior Light Industrial Coating, Water Based (MPI Gloss Level 3)
No. 215-07 Interior Epoxy-Modified Latex, Semi-Gloss

H. Steel Structures Painting Council (SSPC):
SSPC SP 1-04 (R2004) Solvent Cleaning
SSPC SP 2-04 (R2004) Hand Tool Cleaning
SSPC SP 3-04 (R2004) Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plastic Tape:

1. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.
2. Pressure sensitive adhesive back.
3. Widths as shown.

B. Identity markers options:
1. Pressure sensitive vinyl markers.
2. Snap-on coil plastic markers.

C. Aluminum Paint (AP): MPI 1.

D. Exterior Alkyd Enamel (EO): MPI 9.

E. Exterior Latex, Flat (AE): MPI 10.

F. Exterior Latex, Semi-Gloss (AE): MPI 11.

G. High Heat Resistant Coating (HR): MPI 22.

H. Cementitious Galvanized Metal Primer: MPI 26.

I. Interior Satin Latex: MPI 43.

J. Interior Low Sheen Latex: MPI 44.

K. Interior Primer Sealer: MPI 45.

L. Interior Enamel Undercoat: MPI 47.

M. Interior Alkyd, Semi-Gloss (AK): MPI 47.

N. Interior Alkyd, Gloss (AK): MPI 49.

O. Interior Latex Primer Sealer: MPI 50.

P. Interior Alkyd, Eggshell: MPI 51

Q. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.

R. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.

S. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.

T. Epoxy Cold Cured, Gloss (EC): MPI 77.

U. Marine Alkyd Metal primer: MPI 79.

V. Exterior Alkyd, Semi-Gloss (EO): MPI 94.

W. Fast Drying Metal Primer: MPI 95.

X. High Build Epoxy Coating: MPI 98.

Y. Epoxy Anti-Corrosive Metal Primer: MPI 101.

Z. High Build Epoxy Marine Coating (EC): MPI 108.

AA. Interior latex, Gloss (LE) and (LG): MPI 114.

BB. Bonding Primer, Water-Based: MPI 117

CC. Exterior Latex, High Gloss (acrylic) (AE): MPI 119.

DD. Waterborne Galvanized Primer: MPI 134.

EE. Non-Cementitious Galvanized Primer: MPI 135.

FF. Interior High Performance Latex, MPI Gloss Level 2(LF): MPI 138.

GG. Interior High Performance Latex, MPI Gloss Level 3 (LL): MPI 139.

HH. Interior High Performance Latex, MPI Gloss Level 4: MPI 140.

II. Interior High Performance Latex (SG), MPI Gloss Level 5: MPI 141.

JJ. Interior Light Industrial Coating, Water Based (MPI Gloss Level 3): MPI 151

KK. Interior Epoxy-Modified Latex, Semi-Gloss: MPI 215

2.2 PAINT PROPERTIES

A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
   1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
   2. Lead-Base Paint:
      a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
      b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
   3. Asbestos: Materials shall not contain asbestos.
   4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
   5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
   6. Use high performance acrylic paints in place of alkyd paints, where possible.
   7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
   1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
   2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.

B. Atmospheric and Surface Conditions:
   1. Do not apply coating when air or substrate conditions are:
      a. Less than 3 degrees C (5 degrees F) above dew point.

b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
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.

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. Zinc-Coated (Galvanized) Metal, Aluminum, Surfaces Specified Painted:
   1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
   2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non- Cementitious Galvanized Primer) depending on finish coat compatibility.

E. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:
   1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
   2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
   3. 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.
   4. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

F. Gypsum Plaster and Gypsum Board:
   1. Remove efflorescence, loose and chalking plaster or finishing materials.
   2. Remove dust, dirt, and other deterrents to paint adhesion.
   3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

3.3 PAINT PREPARATION

A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.

B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.

D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.

E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.

B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.

C. Apply each coat evenly and cover substrate completely.

D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.

E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.

F. Apply by brush, roller or spray, except as otherwise specified.

G. Do not spray paint in existing occupied spaces unless approved by Resident Engineer, except in spaces sealed from existing occupied spaces.

1. Apply painting materials specifically required by manufacturer to be applied by spraying.
2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

H. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.5 PRIME PAINTING

A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.

B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.

C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.

D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.

E. Metals except high temperature piping :
1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer). Use MPI 101 (Cold Curing Epoxy Primer) where MPI 108 (High Build Epoxy Marine Coating (EC)) finish is specified.
2. Zinc-coated steel and iron: MPI 135 (Non-Cementitious Galvanized Primer) .
3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
4. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
5. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel (EO)).
6. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating (HR)).

F. Gypsum Board :
1. Surfaces scheduled to have MPI 52 (Interior Latex, MPI Gloss Level 3 (LE) use one coat of MPI 50 (Interior latex primer) except use MPI 45 (Interior Primer Sealer) in shower and bathrooms.
2. Surfaces scheduled to have MPI 215 (Interior Epoxy – Modified Latex, Semi-Gloss) Use one coat of MP117 (Bonding Primer, water-based).

3.6 EXTERIOR FINISHES

A. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES. Also see 09 91 13 EXTERIOR PAINTING for additional information.

B. Steel and Ferrous Metal:
1. Two coats of MPI 108 (High, Build Epoxy Manie Coating (EC) 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 heat exchangers, vents, steam and condensate piping .

C. Machinery without factory finish except for primer: One coat MPI 9 (Exterior Alkyd Enamel (EO)) .

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 MPI151 (Interior Light Industrial Coating, Water Based (MPI Gloss Level 3)) unless specified otherwise.
   b. Ferrous Metal over 94 degrees K (200 degrees F): High Temperature piping that is not insulated: One coat MPI 22 (High Heat Resistant Coating (HR).

C. Gypsum Board:
1. Two coats of MPI 52 (Interior Latex, MMPI Gloss Level 3 (LE).
2. Two Coats of MPI 215 (interior Epoxy-Modified Latex, Semi-Gloss).

D. Miscellaneous:
1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
2. MPI 1 (Aluminum Paint): Two coats of aluminum paint where scheduled.

3.8 PAINT COLOR

A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.

B. Coat Colors:
1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

C. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
1. Paint to match color of casework where casework has a paint finish.
2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.9 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.

B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified under paragraph H, colors.

C. Paint various systems specified in Division 02 – EXISTING CONDITIONS, Division 21 – FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 – HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 – ELECTRONIC SAFETY AND SECURITY.

D. Paint after tests have been completed.

E. Omit prime coat from factory prime-coated items.

F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.

G. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.

H. Color:

1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
   a. White Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
   b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water treatment 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.

I. Apply paint systems on properly prepared and primed surface as follows:
   1. Exterior Locations:
      a. Apply two coats of MPI 108 (Hight Build Epoxy Marine Cating (EC) to the following ferrous metal items:
         1) Vent and exhaust pipes with temperatures under 94 degrees C (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
      b. Apply one coat of MPI 22 (High Heat Resistant Coating (HR)), 650 degrees C (1200 degrees F) to high temperature piping that is not insulated.
   2. Interior Locations:
      a. Apply two coats of MPI 151 (Interior Light Industrial Coating, Water Based (MPI Gloss Level 3)) 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, electric conduits and panel boards.
         3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
      b. 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) Steam line flanges, bare pipe, fittings, valves, hangers and supports over 94 degrees K (200 degrees F).

3.10 BUILDING AND STRUCTURAL WORK FIELD PAINTING

A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11 B.
   1. Painting and finishing of new 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.
10. Structural steel encased in concrete, masonry, or other enclosure.
11. Structural steel to receive sprayed-on fire proofing.
12. Ceilings, walls, columns in interstitial spaces.
13. Ceilings, walls, and columns in pipe basements.

3.11 IDENTITY PAINTING SCHEDULE

A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.
   1. Legend may be identified using 2.1 G options or by stencil applications.
   2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12 000 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
   3. Locate Legends clearly visible from operating position.
   4. Use arrow to indicate direction of flow.
   5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
      a. High Pressure - 414 kPa (60 psig) and above.
      b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
      c. Low Pressure - 103 kPa (14 psig) and below.
      d. Add Fuel oil grade numbers.
   6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACK-GROUND	COLOR OF LETTERS	LEGEND ABBEVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Shop Compressed Air		Yellow	Black	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Yellow	Black	H.P. _____*
High Pressure Condensate Return		Yellow	Black	H.P. Ret ____*
Medium Pressure Steam		Yellow	Black	M. P. Stm ____*
Medium Pressure Condensate Return		Yellow	Black	M.P. Ret _____*
Low Pressure Steam		Yellow	Black	L.P. Stm _____*
Low Pressure Condensate Return		Yellow	Black	L.P. Ret _____*
High Temperature Water Supply		Yellow	Black	H. Temp Wtr Sup
High Temperature Water Return		Yellow	Black	H. Temp Wtr Ret
Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup
Hot Water Heating Return		Yellow	Black	H. W. Htg Ret
Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade		Green	White	Fuel Oil-Grade __*
Boiler Water Sampling		Yellow	Black	Sample
Chemical Feed		Yellow	Black	Chem Feed
Continuous Blow-Down		Yellow	Black	Cont. B D
Pumped Condensate		Black		Pump Cond
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent
Alkali		Yellow	Black	Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Black	Yellow	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent

Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Yellow	Black	Acid Waste
Vent		Yellow	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler		Red	White	Auto Spr
Standpipe		Red	White	Stand
Sprinkler		Red	White	Drain

Hot Water Supply Domestic/Solar Water H.W. Sup Dom/SW
Hot Water Return Domestic/Solar Water H.W. Ret Dom/SW

7. See Sections for methods of identification, legends, and abbreviations of the following:
   a. Laboratory gas and vacuum lines: Section 22 63 00, GAS SYSTEMS FOR LABORATORY FACILITIES.
   b. Medical Gases and vacuum lines: Section 22 63 00, GAS SYSTEMS FOR LABORATORY FACILITIES.
   c. 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 and Smoke Partitions:
   1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
   2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
   3. Locate not more than 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.
   4. Use semigloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:
   1. Apply stenciled number and letters to correspond with grid numbering and lettering shown.
   2. Paint numbers and letters 100 mm (4 inches) high, locate 450 mm (18 inches) below overhead structural slab.
   3. Apply on four sides of interior columns and on inside face only of exterior wall columns.
   4. Color:
      a. Use black on concrete columns.
      b. Use white or contrasting color on steel columns.

3.12 PROTECTION CLEAN UP, AND TOUCH-UP

A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.

C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

END OF SECTION

SECTION 09 91 13.01
EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Exterior Painting, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Definitions:
   1. "Paint" and "painting" refer to applied coatings.
   2. Mechanical work and equipment: Work included in Mechanical Specification Divisions.
   3. Electrical work and equipment: Work included in Electrical Specification Divisions.

B. Work included:
   1. Exterior surfaces scheduled to be painted, unless indicated to be painted under other sections.
   2. Except for colored, split-face, patterned, ground-face, glazed, and other concrete masonry units with integral architectural finish; paint exposed exterior and on-site concrete masonry unit surfaces, including areaway walls, backside faces of parapets, screen walls, and retaining walls.
   3. Mechanical and electrical work:
      a. Exterior equipment and items not completely factory finished.

1.3 SUBMITTALS

A. Product data:
   1. Manufacturer's data for each paint type to be applied indicating conformance to specifications.

B. Samples:
   1. Manufacturers complete range of colors for selection.
   2. Gloss samples.

C. Contract closeout information:
   1. Maintenance data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide paint as product of one manufacturer as far as possible.

B. Paint, stain, and coating systems listed are Sherwin Williams unless noted otherwise.
   1. Use comparable performance and aesthetic requirements for paints by Optional manufacturers.

C. Paints:
   1. Base:

a. Benjamin Moore.
2. Optional:
a. Sherwin Williams.
b. ICI Dulux Paint.
c. PPG Architectural Finishes.
d. Pratt & Lambert.

D. Or Approved Equal.

2.2 MATERIALS

A. Paints : As Scheduled in Part 3.
1. Unscheduled items: Bring to the attention of Architect.
2. Colors:
a. Architect reserves right to select colors from entire range of manufacturer's colors, including deep colors.
b. Mechanical: See Division 23.Gloss range: MPI Standards as measured in accordance with ASTM-D523:
c. Gloss Level 1 (Flat): Maximum 5 at 60 degrees, maximum 10 at 85 degrees.
d. Gloss Level 2 (Velvet): Maximum 10 at 60 degrees, 10-35 at 85 degrees.
e. Gloss Level 3 (Eggshell): 10-25 at 60 degrees, 10-35 at 85 degrees.
f. Gloss Level 4 (Satin): 20-35 at 60 degrees, minimum 35 at 85 degrees.
g. Gloss Level 5 (Semi-gloss): 35-70 at 60 degrees.
h. Gloss Level 6 (Gloss): 70-85 at 60 degrees.
i. Gloss Level 7 (High gloss): More than 85 at 60 degrees.
4. If the gloss range is not indicated, provide top coat with a MPI Gloss Level 3 (Eggshell) finish.
5. Submit gloss samples for approval prior to use.
6. Add flatteners if necessary to achieve specified gloss.
7. Part 3 includes a listing of surfaces and type of paint to be applied.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces carefully for defects which cannot be corrected and might prevent satisfactory results.

B. Commencing of work in a specific area constitutes acceptance of surfaces, and responsibility for performance.

3.2 SURFACES NOT TO BE PAINTED

A. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.

B. Moving parts of valves, operating units, mechanical and electrical parts, such as valve and damper operators, sending devices, motor and fan shafts.

C. Code labels, such as UL, FM that are mylar or flat (non-embossed) plates.
1. Embossed plates and labels stamped into frames will be painted, label and information on label to be readily visible and convenient for identification by authority having jurisdiction.

D. Equipment identification or rating plates.

E. Items having complete factory finish with exception of:
1. Exterior mechanical equipment.

2. Exterior electrical equipment.

3.3 PREPARATION - GENERAL

A. Assure that surfaces are clean and dry.

B. Assure that surfaces are free of foreign materials which will affect adhesion or appearance.

C. Remove mildew and neutralize surface.

D. Eliminate efflorescence before painting.

E. Before painting, test surfaces with moisture meter.

F. Paint when moisture is within paint manufacturer's acceptable limits.

3.4 PREPARATION - EXISTING SURFACES

A. Wherever existing work is cut, patched, or added to; touch up to match new work as closely as possible.
   1. Check compatibility of new coating to previously painted surfaces by applying test patch. Allow to dry and test adhesion before continuing painting work.

B. Put existing work scheduled for repainting in condition to provide good adhesion and to receive paint.
   1. Wash thoroughly surfaces to be repainted with abrasive kitchen cleaner or sand to manufacturer's recommendations.
   2. Remove residue from cleaning and abrading procedures.
   3. Spot prime bare areas.

C. Where a wall or ceiling is disturbed and patched, repaint entire wall or ceiling.

D. On surfaces to be refinished remove hardware, accessories, plates, surface mounted lighting fixtures, and similar items not to be coated, or provide protection during preparation and coating operations.

E. Protect (and do not paint) code labels, such as UL, FM that are mylar or flat (non-embossed) plates.
   1. Embossed plates and labels stamped into frames may be painted, label and information on label to be readily visible and convenient for identification by authority having jurisdiction.

3.5 MATERIAL PREPARATION

A. Mix and prepare materials per manufacturer's specifications.

B. Stir, agitate or blend materials to produce a mixture of uniform density as required for application of materials.

3.6 PREPARATION - FERROUS METAL SURFACES AND HOLLOW METAL

A. Follow requirements of SSPC SP1 and SP3.
   1. Except where higher prep levels are indicated.

B. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.

C. Touch up damaged shop coats.

D. For surfaces with touched up shop coat, omit first coat.

E. Hollow metal frame joints at intersections of Rabbets, Stops, and Soffit Joints:
   1. Neatly fill corner seam with painter's caulk (in field) prior to painting.

3.7 PREPARATION - GALVANIZED METAL SURFACES AND NON-ANODIZED ALUMINUM

A. Follow requirements of SSPC SP1.

B. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.

3.8 PREPARATION - GYPSUM WALLBOARD

A. Repair minor irregularities left by finishers.

B. Exercise care to avoid raising nap of paper.

C. Apply prime coat.

D. Notify gypsum wallboard finisher to repair and refinish areas which indicate defects after application of primer.

E. Re-prime refinished areas.

3.9 PREPARATION – CONCRETE

A. Repair minor defects.

B. Remove oil from concrete by washing with xylol.

C. Block Filler:
   1. Apply masonry to fill pinholes and minor surface defects, and to prime surface for topcoat(s).
   2. Apply by brush, roller or sprayer.
      a. Where spray-applied: Back-roll with roller or squeegee.
   3. Minimum Nominal Thickness: 10 mil DFT.
      a. Comply with manufacturer’s recommended coverage rates for conditions encountered.
   4. Provide complete cover with recommended coating system.

D. Obtain architect's approval of finish for surfaces to receive high build glazed coatings.

3.10 APPLICATION - GENERAL

A. Paint surfaces as specified in paragraphs "Schedule - Exterior Paint Systems".

B. Provide complete coverage and hide.
   1. Paint systems are to cover.
   2. When color or undercoats show through, apply additional coats at no additional cost until paint film is of uniform finish and color.

C. Employ only skilled mechanics.

D. Mix and apply as recommended by manufacturer.

E. Install when temperature, humidity, and surface conditions are acceptable to manufacturer.

F. If Architect so directs, do not apply succeeding coats until Architect has an opportunity to observe previous coat.

G. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.

H. Upon completion of painting, carefully replace removed items and/or remove protection.

I. Apply materials under adequate illumination.

J. Evenly spread and smoothly flow on for full, smooth cover.

K. Assure that coats are dry before recoating.

L. Touch up suction or hot spots in plaster, concrete block, and concrete before painting.

M. Touch up abraded areas of shop prime coats before subsequent coats are applied.

N. Back prime wood trim with penetrating sealer.

O. Finish colors not indicated shall be selected by Architect from paint manufacturer's standard colors.

3.11 PROTECTION AND CLEANUP

A. Protect adjacent work against damage by painting and finishing work.

B. Clean, repair or replace, and repaint damaged work as directed by Architect.

C. Provide "WET PAINT" signs.

D. Remove temporary protective wrappings, after completion of operations.

E. Clean paint spattered surfaces.

F. Use care not to damage finished surfaces.

G. Remove surplus materials, scaffolding and debris.

H. Leave areas broom clean.

3.12 SCHEDULE - EXTERIOR PAINT SYSTEMS

A. Concrete and GFRC:
   1. Elastomeric, smooth:
      a. Sherwin Williams:
         1) Primer coat: Loxon Acrylic Primer; A24 W300.
         2) Intermediate coat: ConFlex XL Elastomeric High Build Smooth; A5-400.
         3) Topcoat: ConFlex XL Elastomeric High Build Smooth; A5-400.
      b. ICI:
         1) Primer coat: Prep & Prime Hydrosealer Waterborn Multipurpose Primer Sealer; 6001.
         2) Intermediate coat: Decra-Flex 300 Elastomeric Coating; 2260.
         3) Topcoat: Exterior: Decra-Flex 300 Elastomeric Coating; 2260.
      c. PPG:
         1) Primer coat: Perma-Crete Acrylic Primer; 4-2.
         2) Intermediate coat: Pitt Flex Elastomeric: 4-110.
         3) Topcoat: Pitt Flex Elastomeric: 4-110.
   2. Waterproof:
      a. Sherwin Williams:
         1) Primer coat: Loxon XP; A24.
         2) Topcoat: Loxon XP; A24.
      b. ICI:
         1) Primer coat: Prep & Prime Hydrosealer Waterborn Multipurpose Primer Sealer; 6001.
         2) Topcoat: Prep & Prime Hydrosealer Waterborn Multipurpose Primer Sealer; 6001.
      c. PPG:
         1) Primer coat: Perma-Crete Acrylic Texture Paint; 4-50.
         2) Topcoat: Perma-Crete Acrylic Texture Paint; 4-50.

B. Plaster:
   1. Elastomeric, smooth:
      a. Sherwin Williams:
         1) Primer coat: Loxon Acrylic Primer; A24 W300.
         2) Intermediate coat; ConFlex XL Elastomeric High Build Smooth; A5-400.
         3) Topcoat: ConFlex XL Elastomeric High Build Smooth; A5-400.
      b. ICI:
         1) Primer coat: Prep & Prime Hydrosealer Waterborn Multipurpose Primer Sealer; 6001.
         2) Intermediate coat: Decra-Flex 300 Elastomeric Coating; 2260.
         3) Topcoat: Exterior: Decra-Flex 300 Elastomeric Coating; 2260.
      c. PPG:
         1) Primer coat: Perma-Crete Block Surfacer; 4-100.
         2) Intermediate coat: Pitt Flex Elastomeric; 4-110.
         3) Topcoat: Pitt Flex Elastomeric; 4-110.
   2. Elastomeric, textured:
      a. Sherwin Williams:
         1) Primer coat: Loxon Acrylic Primer; A24 W300.
         2) Intermediate coat: ConFlex XL Elastomeric High Build Smooth; A5-400.
         3) topcoat: ConFlex XL Textured Elastomeric High Build Medium; A5-800.
      b. Benjamin Moore:
      c. ICI:
         1) Primer coat: Prep & Prime Hydrosealer Waterborn Multipurpose Primer Sealer; 6001.
         2) Intermediate coat: Decra-Flex 300 Elastomeric Coating; 2290.
         3) Topcoat: Exterior: Decra-Flex 300 Elastomeric Coating; 2290.
      d. PPG:
         1) Primer coat: Perma-Crete Acrylic Primer; 4-2.
         2) Intermediate coat: Pitt Flex Elastomeric; 4-110.
         3) Topcoat: Pitt Flex Elastomeric Textured; 4-210.

C. Metal doors and frames; Metal stairs, handrails, and guardrails; Miscellaneous metals (ferrous, primed, zinc-coated, and aluminum):
   1. Water based urethane, Gloss Level 6 (Gloss):
      a. Sherwin Williams:
         1) Primer coat: Pro-Cryl Universal Acrylic Primer, B66-310 Series.
         2) Intermediate coat: Acrolon 100 Water Based Urethane Gloss, B65-720.
         3) Topcoat: Acrolon 100 Water Based Urethane Gloss, B65-720.
      b. ICI:
         1) Primer coat: Universal Epoxy Primer; 205.
         2) Intermediate coat: Devthane UVA Aliphatic Urethane; 379.
         3) Topcoat: Devthane UVA Aliphatic Urethane; 379.
      c. PPG:
         1) Primer coat: Pitt Tech 100% Acrylic Primer; 90-712.
         2) Intermediate coat: Pitthane Ultra Gloss Urethane 95-812.
         3) Topcoat: Pitthane Ultra Gloss Urethane 95-812.

D. Structural steel (exposed):
   1. Water based urethane, Gloss Level 6 (Gloss):
      a. Sherwin Williams:
         1) Primer coat: Shop-applied.
            a) Touch-up in field as required.
         2) Intermediate coat: Acrolon 100 Water Based Urethane Gloss, B65-720.
         3) Topcoat: Acrolon 100 Water Based Urethane Gloss, B65-720.

4) Clear coat: Diamond-Clad Clear Coat Urethane, B65 Series.

b. ICI:
   1) Primer coat: Shop-applied.
      a) Touch-up in field as required.
   2) Intermediate coat: Devthane UVA Aliphatic Urethane Gloss Enamel; 389.
   3) Topcoat: Devthane UVA Aliphatic Urethane Gloss Enamel; 389.
   4) Clear coat: Manufacturer recommended.

c. PPG:
   1) Primer coat: Shop-applied.
      a) Touch-up in field as required.
   2) Intermediate coat: Pitthane Ultra Gloss Urethane 95-812.
   3) Topcoat: Pitthane Ultra Gloss Urethane 95-812.
   4) Clear coat: Pitthane Ultra Gloss Urethane 95-812.

END OF SECTION

SECTION 09 96 59
HIGH-BUILD GLAZED COATINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies a special coating (SC) system designed to provide on interior masonry or other surfaces a glazed tile like finish.

1.2 RELATED WORK

A. Provide materials, labor & equipment required to preparte designated wall area and install wall system as shown on the drawings.

B. Location, color and texture (Class): Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 QUALITY ASSURANCE

A. Manufacturer: Obtain all wall system materials required for this section from a single manufacturer.

B. Contractor: shall have a minimum of 10 years experience in the installation of seamless walls. Shall be approved installer of manufacturer specified.

1.4 SUBMITTALS

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

B. Samples:
   1. Material samples, 12 inches square, showing the number of coats of each coating material on each substrate to which the material is to be applied. Apply coating to the samples in a setback procedure, leaving exposed a portion of the substrate and subsequent portions of each coat.
   2. Color samples, minimum 75 mm (three inches) by 125 mm (five inches) of each color and texture (Class) specified.

C. Certificates:
   1. Certifying that the coating complies with requirements of this specification, including resistance to abrasion and resistance to perspiration.
   2. Certifying that the coating supplied is the same, with manufacturing tolerances, as the coating tested.

D. Manufacturer's Literature and Data:
   1. Physical properties
   2. Performance properties
   3. Material Safety Data sheets

E. Literature and data describing the coating material to be furnished. Printed application for instructions for each substrate.

F. Test Reports: Reports of tests certifying compliance with requirement specified.

G. Warranty: Furnish manufacturer's written warranty on seamless walls, for period of two years after installation., warranting against loss of bond and wear through to concrete substrate (through normal wear and use). Warrant shall be single source from the manufacturer, including material and labor.

1.5 DELIVERY, HANDLING AND STORAGE

A. Deliver materials in manufacturer's unopened, undamaged containers, clearly marked with the following:
   1. Product Name
   2. Manufacturer's Name
   3. Resin or Hardener Designation
   4. Mix Ratio of Resin and Hardener

B. Handle materials in a safe and proper manner to avoid damage or spills.

C. Inspect direct job site deliveries to verify correct material and quantities are received in good condition.

D. Replace, at no cost to the owner, materials that are found to be defective in manufacturing or damaged in transit, handling or storage.

E. Store materials per manufacturer's instructions and as follows:
   1. Seals and labels shall be intact and legible.
   2. Temperature of storage area shall be maintained between 60°F and 85°F.
   3. Do not use materials which have been stored for a longer period of time than the manufacturer's maximum recommended shelf life.

1.6 JOB SITE CONDITIONS

A. Pre-Installation conference shall be required with General Contractor, Owners Representative, Seamless Contractor and/or Manufacturer's Representative to review the following:
   1. Evaluate substrate conditions and extent of repairs necessary for Contractor to begin normal preparation and installation of seamless wall finishes.
   2. Evaluate detail conditions at all penetrations, terminations and perimeter locations. Detail problems should be documented and resolved prior to wall installation.
   3. Test concrete substrates to verify that substrate moisture content does not exceed that recommended by wall system manufacture.
   4. Review job site conditions, including temperature, power, and lighting, necessary for a successful installation.

B. Protect surrounding substrate and surfaces, as well as in place equipment, from damage during surface preparation and system installation.

C. Job area shall be free of other trades during wall installation, and for a period of 48 hours upon completion.

D. General Contractor shall provide adequate ventilation by use of fans or other devices.

E. General Contractor shall maintain lighting at a minimum uniform level equivalent to the end use conditions in the areas where the seamless wall system is being installed. If possible, schedule installation so that permanent lighting will be operational during installation.

F. General contractor shall ensure that leaks from pipes and other sources are corrected prior to wall installation.

G. General Contractor shall provide minimum substrate temperatures of 65 degrees F and atmospheric temperature of 70 degrees F with relative humidity below 85% during wall installation and until final acceptance.

1.7 APPLICABLE PUBLICATIONS

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

B. The Master Painters Institute (MPI):
   1. Approved Product List – 2010

PART 2 - PRODUCTS

2.1 HIGH BUILD EPOXY WALL SYSTEM

A. . Wall Systems Overview. The wall system specified shall be SeamTek GlassWall Reinforced Wall System by Seamless Technologies, Inc. or approved equal. This system is a high build epoxy wall system including 5.6 oz. fiberglass mat applied in a minimum thickness of 25-30 mls Dry Film Thickness (DFT). The system shall be pinhole free. Use 100% solids epoxy resins, no solvent containing materials will be allowed. When applying over CMU or poured concrete walls extra steps must be taken to parge or otherwise make the substrate smooth and suitable for fiberglass.

B. Wall Systems Overview The wall system specified shall be SeamTek GlassWall NR by Seamless Technologies, Inc. or approved equal. This system is a high build epoxy wall finish applied in a minimum thickness of 12-16 mls Dry Film Thickness (DFT). The system shall be pinhole free. Use 100% solids epoxy resins, no solvent containing materials will be allowed. When applying over CMU do not use block fillers that contain PVA.

C. Epoxy Physical Properties For GlassWall Reinforced

Hardness Shore D	ASTM D-1706	70 - 80
Tensile Strength	ASTM D-638	3,000 psi min.
Flexural Strength	ASTM D-790	4,000 psi min.
Thermal Shock	Mil F-52505	No cracking or loss of adhesion
Abrasion Resistance (Taber Abrader, CS-17 Wheels, 1000 gm. load, 1000 cycles)	ASTM D-4060	.035 gm loss
Ultimate Elongation	ASTM D-638	20% min.
Chemical Resistance	20% Acetic Acid	Occasional Spill
	50% Citric Acid	Good
	20% Nitric Acid	Occasional Spill
	30% Hydrochloric Acid	Occasional Spill
	10% Hydrofluoric Acid	Occasional Spill
	Hydrogen Peroxide	Good
	40% Potassium Hydroxide	Good
	40% Sodium Hydroxide	Good
	50% Sulfuric Acid	Good
	Urea	Good
Hardness Shore D	ASTM D-1706	70 - 80

PART 3 - EXECUTION

3.1 PREPARATION OF SURFACES

A. Patch surfaces as required for receiving epoxy wall system. Make surfaces smooth and free of voids & pinholes. . Assure surfaces are clean, dry, well cured, sound and free of ridges and depressions.

B. Previous Coatings: Remove flaking, scaling or unsound coatings. Sand sound previous coatings to remain, with medium sand paper to eliminate gloss and provide tooth.

C. Remove or protect items not requiring coating.

3.2 APPLICATION

A. Finish Film Thickness: Apply materials at not less than the manufacturer's recommended spreading rate.

B. On previously coated surfaces, apply one base coat and one finish coat.

C. On bare concrete block and cast in place concrete apply two base coats and one finish coat.

D. On bare gypsum board apply one primer coat, one base coat and one finish coat, or as recommended by product manufacturer

E. In rooms or spaces shown or specified to have glazed coating, apply the glazed coating to surfaces behind casework and equipment, except behind those items built into wall recesses.

F. Make edges of glazed coatings sharp and clean without overlapping adjoining other materials or colors.

G. Wall ceiling joints shall have radius corners. The radius corner shall be a 1” radius installed on the gypsum board prior to any high performance coating or painting. All coatings shall cover the wall and joint in the application. The wall coating shall cover the entire radius, terminating on the ceiling, directly following the end of the corner radius. The radius material will be epoxy resin with aggregates and/or glass filler material suitable for creating and forming a radius corner at the wall ceiling joint. Radius corners shall not be made of “dry wall mud” or any other “non-resin” materials.

H. Apply glazed coating in areas specified under Section 09 06 00, SCHEDULE FOR FINISHES.

3.3 CLEANING AND PROTECTION

A. During progress of the work and upon completion, promptly clean adjacent surfaces and materials of spills, spatters, drips, and stains from glazed coatings application. Remove glazed coatings by proper methods exercising care to prevent damage to finished surfaces and materials.

B. Protect work of other trades against damage resulting from glazed coatings work.

C. Touch up damaged coating surfaces before final acceptance.

END OF SECTION

SECTION 10 21 13
TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies metal toilet partitions, and urinal screens.

1.2 RELATED WORK

A. Overhead structural steel supports for ceiling hung pilasters: Section 05 50 00, METAL FABRICATIONS.

B. Color of baked enamel finish: Section 09 06 00, SCHEDULE FOR FINISHES.

C. Grab bars and toilet tissue holders: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES.

1.3 SUBMITTALS

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

B. Samples: Prime coat of paint on 150 mm (six-inch) square of metal panel with baked enamel finish coat over half of panel.

C. Manufacturer's Literature and Data: Specified items indicating all hardware and fittings, material, finish, and latching.

D. Shop Drawings: Construction details at 1/2 scale, showing installation details, anchoring and leveling devices.

E. Manufacturer's certificate, attesting that zinc-coatings conform to specified requirements.

1.4 APPLICABLE PUBLICATIONS

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

B. Federal Specifications (Fed. Spec.):
FF-B-575C Bolt, Hexagon and Square

C. Code of Federal Regulations (CFR):
40 CFR 247 Comprehensive Procurement Guidelines for Products Containing Recovered Materials

D. Commercial Item Descriptions (CID):
A-A-1925 Shield, Expansion (Nail Anchors)
A-A-60003 Partitions, Toilet, Complete

PART 2 - PRODUCTS

2.1 FABRICATION

A. Conform to Fed. CID A-A-60003, except as modified herein.

B. Fabricate to dimensions shown or specified.

C. Toilet Enclosures:
   1. Type 1, Style B (Ceiling hung) .
   2. Reinforce panels shown to receive toilet tissue holders or grab bars.
   3. Upper pivots and lower hinges adjustable to hold doors open 30 degrees.
   4. Latching devices and hinges for handicap compartments shall comply with ADA requirements.
   5. Keeper:
      a. U-slot to engage bar of throw latch.
      b. Combined with rubber bumper stop.
   6. Wheelchair Toilets:
      a. Upper pivots and lower hinges to hold out swinging doors in closed position.
      b. Provide U-type doors pulls, approximately 100 mm (four inches) long on pull side.
   7. Finish:
      a. Finish 1 (baked enamel) on steel doors, pilasters, and enclosure panels except those adjacent to urinals and as specified.
      b. Finish 3 (stainless steel) on panel of enclosure panels adjacent to urinals .

D. Urinal Screens:
   1. Type III, Style D (wall hung), finish 3, and (stainless steel).
      a. With integral flanges and continuous, full height wall anchor plate.
      b. Option: Full height U-Type bracket.
      c. Wall anchor plate drilled for 4 anchors on both sides of screen.
   2. Screen 600 mm (24 inches) wide and 1060 mm (42 inches high).

2.2 FASTENERS

A. Partition Fasteners: CID A-A-60003.

B. Use expansion bolts, CID A-A-60003, for anchoring to solid masonry or concrete.

C. Use toggle bolts, CID A-A-60003, for anchoring to hollow masonry or stud framed walls.

D. Use steel bolts FS-B-575, for anchoring pilasters to overhead steel supports.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install in rigid manner, straight, plumb and with all horizontal lines level.
   2. Conceal evidence of drilling, cutting and fitting in finish work.
   3. Use hex-bolts for through-bolting.
   4. Adjust hardware and leave in freely working order.
   5. Clean finished surfaces and leave free of imperfections.

B. Panels and Pilasters:
   1. Support panels, except urinal screens, and pilaster abutting building walls near top and bottom by stirrup supports secured to partitions with through-bolts.
   2. Secure stirrups to walls with two suitable anchoring devices for each stirrup.
   3. Secure panels to faces of pilaster near top and bottom with stirrup supports, through-bolted to panels and machine screwed to each pilaster.
   4. Secure edges of panels to edges of pilasters near top and bottom with "U" shaped brackets.

C. Urinal Screens:

1. Anchor urinal screen flange to walls with minimum of four bolts both side of panel.
2. Space anchors at top and bottom and equally in between.

END OF SECTION

SECTION 10 21 31.01
SHOWER CURTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Shower Curtains, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Curtain fabric flame resistance: NFPA-701.

1.3 SUBMITTALS

A. Samples.
   1. Fabric.

B. Contract closeout information:
   1. Maintenance data.
   2. Warranty.

1.4 WARRANTY

A. Warrant materials and installation for a period of two (2) years to comply with specifications and free of defective workmanship. Warrant to cover cost of replacement curtain, including removal, replacement, and disposal of defective material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fabrics:
   1. Base:
      a. Brite Ink.
      b. Hospital

B. Shower Curtain Rod: See Section 10 28 00.

C. Or Approved Equal.

2.2 MATERIALS

A. General:
   1. Nylon Fabric shall be made from pre-shrunk, yarn dyed, permanently flame proofed, manufacturer's standard pattern and texture.
   2. Provide and install shower curtains in rooms as shown on schedule.
   3. Field verify all dimensions prior to installation to provide complete enclosure.
   4. Curtains shall be manufactured to a length with a tolerance of plus or minus 1 IN. Care and location labels are sewn into the reverse side of right hem, approximately 6 IN above bottom hem.

B. Curtains:
   1. Fabric A:
      a. Pattern:TBD .
      b. Color: TBD.

C. Shower curtain Rod: See Section 10 28 00.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions.

B. Correct unsatisfactory conditions prior to installation.

3.2 INSTALLATION

A. Install curtains wrinkle free immediately prior to final inspection.

B. Replace damaged or defective curtains.

3.3 SCHEDULE

A. Install shower curtains on tracks as indicated in Shower Curtain Schedule.

END OF SECTION

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies wall guards (crash rails or bumper guards), corner guards and door/door frame protectorsand high impact wall covering .

1.2 RELATED WORK

A. Structural steel corner guards: Section 05 50 00, METAL FABRICATIONS.

B. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.

C. Color and texture of aluminum and resilient material: 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: Show locations, extent, design and installation details.

C. Manufacturer's Literature and Data:
   1. Wall Guards.
   2. Corner Guards.
   3. Door/Door Frame Protectors.
   4. High Impact Wall covering

D. Test Report: Showing that resilient material complies with specified fire and safety code requirements.

1.4 QUALITY ASSURANCE

A. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

B. Manufacturer’s qualifications: Not less than 5 years experience in the production of specified products and a record of successful in-service performance.

C. Fire performance characteristics: Provide engineered PETG wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class 1 characteristics listed below:
   1. Flame spread: 25 or less
   2. Smoke developed: 450 or less

D. Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476.

E. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D543.

F. Color match: Provide wall protection components that are color matched in accordance with the following:
   1. Delta Ecmc of no greater than 1.0 using CIELab color space. (Specifier note: Construction Specialties' colors are matched under cool white fluorescent lighting and computer controlled within manufacturing tolerances. Color may vary if alternate lighting sources are present).

G. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.5 DELIVERY AND STORAGE

A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.

B. Protect from damage from handling and construction operations before, during and after installation.

C. Store in a dry environment of approximately 21° C (70 degrees F) for at least 48 hours prior to installation.

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):

A167-99(R2004)	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
B221-07	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
D256-06	Impact Resistance of Plastics
D635-06	Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
E84-07	Surface Burning Characteristics of Building Materials

C. The National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series	Metal Finishes Manual

D. National Fire Protection Association (NFPA):

80-06	Standard for Fire Doors and Windows

E. Society of American Automotive Engineers (SAE):

J 1545-05	Instrumental Color Difference Measurement for Exterior Finishes.

F. Underwriters Laboratories Inc. (UL):

Annual Issue	Building Materials Directory

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A167, Type 302B.

B. Aluminum Extruded: ASTM B221, Alloy 6063, Temper T5 or T6. Aluminum alloy used for colored anodizing coating shall be as required to produce specified color.

2.2 CORNER GUARDS

A. Stainless Steel Corner Guards: Fabricate of 1.6 mm (0.0625 inch) thick stainless steel. Form guards of dimensions and to contour shown.

2.3 WALL GUARDS

A. Aluminum Wall Guards: Extruded aluminum, (6061-T6) mounted on wall brackets as shown.
   1. Provide wall bumper with factory fabricated end closure caps, and inside and outside corner assemblies, concealed splice plates, and other accessories standard with the manufacturer.
   2. Fabricate wall guards from material with a nominal thickness of 6 mm (0.250 inch), .
   3. Fabricate wall brackets from aluminum . Fasten wall guard to brackets per manufacturer's installation instructions .

2.4 DOOR PROTECTION

A. Refer to Section 08 71 00 door hardware for door protection.

B. Coordinate door protection material requirements with door and frame suppliers to insure fit for all components, and color as specified.

2.5 HIGH IMPACT WALL COVERING

A. Engineered PETG: Rigid sheet should be high impact Acrovyn 4000 with nominal .060" (1.02mm) thickness and supplied in 4' x 8' or 10' (1.22m x 2.44m or 3.05m) sheet sizes in Suede (standard) see finish schedule for color. Specify color-matched caulk, plastic trims or metal trims as needed for joints/transitions.

B. Coordinate with guard rail protection material and supplier for proper fit, installation and color.

C. Wall covering shall be furnished as a complete packaged system, containing all primers and adhesive. Primer and adhesive materials shall be water based and non-hazardous. Provide adhesive as recommended by the wall covering manufacturer.

2.6 FASTENERS AND ANCHORS

A. Provide fasteners and anchors as required for each specific type of installation.

B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.

2.7 FINISH

A. In accordance with NAAMM AMP 500 series.

B. Aluminum:
   1. Exposed aluminum: chemically etched medium matte, with clear anodic coating, Class II Architectural, 0.4 mil thick.
   2. Concealed aluminum: Mill finish as fabricated, uniform in color and free from surface blemishes.

C. Stainless Steel: NAAMM finish Number 4.

PART 3 - INSTALLATION

3.1 STAINLESS STEEL CORNER GUARDS

A. Mount guards on external corners of interior walls, partitions and columns as shown or as recommended by manufacturer.

1. Where corner guards are installed on gypsum board, clean surface and anchor guards with a neoprene solvent type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from around edge of guard and allow to cure undisturbed for 24 hours.

3.2 ALUMINUM WALL GUARDS

A. Secure brackets to walls with fasteners, spaced in accordance with manufacturer's installation instructions.

3.3 DOORPROTECTION AND HIGH IMPACT WALL COVERING

A. Surfaces to receive protection shall be clean, smooth and free of obstructions.

B. Install protectors after frames are in place but preceding installation of doors in accordance with approved shop drawings and manufacturers specific instructions.

C. Install according to manufacture’s recommendations.

D. Immediately upon completion of installation, clean wall covering and accessories in accordance with manufacturer’s recommended cleaning method.

E. Protection installed on fire rated doors and frames shall be installed according to NFPA 80 and installation procedures listed in UL Building Materials Directory; or, equal listing by other approved independent testing laboratory establishing the procedures.

END OF SECTION

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies manufactured items usually used in dressing rooms, toilets, baths, locker rooms and at sinks in related spaces.

B. Items Specified:
1. Paper towel dispenser.
2. Waste receptacles.
3. Toilet tissue dispenser.
4. Grab Bars: .
5. Shower curtain rods:
6. Clothes hooks, robe or coat.
7. Towel bars.
8. Metal framed mirror:
9. Soap dishes.
10. Mop racks.
11. Stainless steel shelves at wheelchair lavatory.
12. Shower seat

C. This section also specifies custom fabricated items used in toilets and related spaces.

1.2 RELATED WORK

A. Color of finishes: Section 09 06 00, SCHEDULE FOR FINISHES

B. Ceramic toilet and bath accessories: Section 09 30 13, CERAMIC TILING

C. Custom fabricated accessories: Section 10 28 00 and TOILET, BATH, ACCESSORIES.

D. Color of vinyl fabric: Section 09 06 00, SCHEDULE FOR FINISHES.

E. Manufactured toilet and bath accessories: Section 10 28 00, TOILET, AND BATH, AND LAUNDRY ACCESSORIES.

1.3 SUBMITTALS

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

B. Shop Drawings:
1. Each product specified.
2. Paper towel dispenser.
3. Metal framed mirrors, showing shelf where required, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.
4. Shower Curtain rods, showing required length for each location.
5. Grab bars, showing design and each different type of anchorage.
6. Show material and finish, size of members, and details of construction, installation and anchorage of mop racks.
7. Shower Seat.

C. Samples:

1. One of each type of accessory specified.
2. After approval, samples may be used in the work.

D. Manufacturer's Literature and Data:
1. All accessories specified.
2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
3. Show working operations of spindle for toilet tissue dispensers.
4. Mop racks.

E. Manufacturer's Certificates:
1. Attesting that soap dispensers are fabricated of material that will not be affected by liquid soap or aseptic detergents, Phisohex and solutions containing hexachlorophene.
2. Anodized finish as specified.

1.4 QUALITY ASSURANCE

A. Each product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

B. Each accessory type shall be the same and be made by the same manufacturer.

C. Each accessory shall be assembled to the greatest extent possible before delivery to the site.

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

1.5 PACKAGING AND DELIVERY

A. Pack accessories individually to protect finish.

B. Deliver accessories to the project only when installation work in rooms is ready to receive them.

C. Deliver inserts and rough-in frames to site at appropriate time for building-in.

D. Deliver products to site in sealed packages of containers; labeled for identification with manufacturer's name, brand, and contents.

1.6 STORAGE

A. Store products in weathertight and dry storage facility.

B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

1.7 APPLICABLE PUBLICATIONS

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

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

A167-99(R2004)	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
A176-99(R2004)	Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
A269-07	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A312/A312M-06	Seamless and Welded Austenitic Stainless Steel Pipes
A653/A653M-07	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

B221-06	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
B456-03	Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
C1036-06	Flat Glass
C1048-04	Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass
D635-06	Rate of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position
F446-85 (R2004)	Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.
A269-07	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
D3453-01	Flexible Cellular Materials - Urethane for Furniture and Automotive Cushioning, Bedding, and Similar Applications
D3690-02	Vinyl-Coated and Urethane-Coated Upholstery Fabrics

C. The National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series	Metal Finishes Manual
AMP 500-505-88	Metal Finishes Manual and Finishes for Stainless Steel

C. American Welding Society (AWS):

D10.4-86 (R2000)	Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing

D. Federal Specifications (Fed. Specs.):

A-A-3002	Mirrors, Glass
FF-S-107C (2)	Screw, Tapping and Drive
FF-S-107C	Screw, Tapping and Drive.
WW-P-541E(1)	Plumbing Fixtures (Accessories, Land Use) Detail Specification

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.

B. Stainless Steel:
   1. Plate or sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
   2. Tube: ASTM A269, Alloy Type 302, 304, or 304L.

C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.

D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.

E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.

F. Glass:
   1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors, and for mirror doors in medicine cabinets.
   2. ASTM C1036, Type 1 Class 1 Quality q3, for shelves in medicine cabinets.
   3. ASTM C1048, Kind FT, Condition A, Type 1, Class 1 (use in Mental Health and Behavior Nursing Unit Psychiatric Patient Areas and Security Examination Rooms where mirrors and glass are specified).

G. Foam Rubber: ASTM D3453, Grade BD, Type 2.

H. Vinyl Covering: ASTM D3690, Vinyl coated fabric, Class A.

I. Plywood: PS1, Grade CD.

2.2 FASTENERS

A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.

B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture areas such as showers or bath tubs use stainless steel).

C. Toggle Bolts: For use in hollow masonry or frame construction.

D. Hex bolts: For through bolting on thin panels.

E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.

F. Screws:
   1. ASME B18.6.4.
   2. Fed Spec. FF-S-107, Stainless steel Type A.

G. Adhesive: As recommended by manufacturer for products to be joined.

2.3 FINISH

A. In accordance with NAAMM AMP 500 series.

B. Anodized Aluminum:
   1. Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.

2.4 FABRICATION - GENERAL

A. Welding, AWS D10.4.

B. Grind dress, and finish welded joints to match finish of adjacent surface.

C. Form exposed surfaces from one sheet of stock, free of joints.

D. Provide steel anchors and components required for secure installation.

E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.

F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.

G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.

H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.

I. Key items alike.

J. Provide templates and rough-in measurements as required.

K. Round and deburr edges of sheets to remove sharp edges.

2.5 PAPER TOWEL DISPENSERS

A. Surface mounted type with sloping top.

B. Dispensing capacity for 300 sheets of any type of paper toweling.

C. Fabricate of stainless steel.

D. Provide door with continuous hinge at bottom, and either spring tension cam lock or tumbler lock, keyed alike, at top and a refill sight slot in front.

2.6 WASTE RECEPTACLES

A. Semi-recessed type, without doors. Fed. Spec WW-P-541, Type II.

B. Fabricate of stainless steel.

C. Form face frame from one piece.

D. Provide removable waste receptacle of approximately (12 gallon) capacity, fabricated of stainless steel.

E. Waste receptacle key locked in place.

2.7 TOILET TISSUE DISPENSERS

A. Double roll surface mounted type.

B. Mount on continuous backplate.

C. Removable spindle ABS plastic or chrome plated plastic.

D. Wood rollers are not acceptable.

2.8 GRAB BARS

A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.

B. Fabricate of either stainless steel or nylon coated steel, except use only one type throughout the project:
   1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
   2. Nylon Coated Steel: Grab bars and flanges complete with mounting plates and fasteners.

C. Concealed mount, except grab bars mounted at floor, swing up and on metal toilet partitions.

D. Bars:
   1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
      a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
      b. Nylon coated bars, minimum 1.5 mm (0.0598 inch) thick.
   2. Fabricate in one continuous piece with ends turned toward walls, except swing up and where grab bars are shown continuous around three sides of showers, bars may be fabricated in two sections, with concealed slip joint between.
   3. Continuous weld intermediate support to the grab bar.
   4. Swing up bars manually operated. Designed to prevent bar from falling when in raised position.

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

F. Flange for Exposed Mounting:
   1. Minimum 5 mm (3/16 inch) thick, approximately 75 mm (3 inch) diameter.

2. Insert grab bar through flange and continuously weld perimeter of grab bar flush to backside of flange.
3. Where mounted on metal toilet partitions, provide three equally spaced, countersunk holes, sized to accommodate 5 mm (3/16 inch) diameter bolts.
4. Where mounted on floor, provide four equally spaced holes, sized to accommodate 5 mm (3/8 inch) diameter bolts, not more than 5 mm (3/8 inch) from edge of flange.

G. In lieu of providing flange for concealed mounting, and back plate as specified, grab rail may be secured by being welded to a back plate and be covered with flange.

H. Back Plates:
1. Minimum 2.65 mm (0.1046 inch) thick metal.
2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
3. Furnish spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on metal partitions.

2.9 SHOWER CURTAIN RODS

A. Stainless steel tubing, ASTM A569, minimum 1.27 mm (0.050 inch) wall thickness, 32 mm (1 1/4 inch) outside diameter.

B. Flanges, stainless steel rings, 66 mm (2 5/8 inch) minimum outside diameter, with 2 holes opposite each other for 6 mm (1/4 inch) stainless steel fastening bolts. Provide a set screw within the curvature of each flange for securing the rod.

C. Intermediate support for rods over 1800 mm (six feet) long. Provide adjustable ceiling flanges with set screws, tubular hangers and stirrups.

2.10 CLOTHES HOOKS-ROBE OR COAT

A. Fabricate hook units either of chromium plated brass with a satin finish, or stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to the thickness of the metal, or 3 mm (1/8 inch) minimum radius.

B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to the wall flange, provided with concealed fastenings.

2.11 TOWEL BARS

A. Fed. Spec. WW-P-541/8B, Type IV, Bar, Surface mounted; Class 1, towel.

B. Either stainless steel, or chromium plated copper alloy.

C. Bar Length: 450 and 600 mm (18 and 24 inches) as shown.

D. Finish of brackets or supports same as bar.

2.12 METAL FRAMED MIRRORS

A. Fed. Spec. A-A-3002 metal frame; stainless steel, type 302 or 304.

B. Mirror Glass:
1. Minimum 6 mm (1/4 inch) thick.
2. Set mirror in a protective vinyl glazing tape.

C. Frames:
1. Channel or angle shaped section with face of frame not less than 9 mm (3/8 inch) wide. Fabricate with square corners.

2. Use either 0.9 mm (0.0359 inch) thick stainless steel, chrome finished steel, or extruded aluminum, with clear anodized finish 0.4 mils thick.
3. Filler:
   a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
   b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.
4. Attached Shelf for Mirrors:
   a. Fabricate shelf of the same material and finish as the mirror frame.
   b. Make shelf approximately 125 mm (five inches) in depth, and extend full width of the mirror.
   c. Close the ends and the front edge of the shelf to the same thickness as the mirror frame width.
   d. Form shelf for aluminum framed mirror as an integral part of the bottom frame member. Form stainless steel shelf with concealed brackets to attach to mirror frame.

D. Back Plate:
1. Fabricate backplate for concealed wall hanging of either zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
2. Use set screw type theft resistant concealed fastening system for mounting mirrors.

E. Mounting Bracket:
1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.

2.13 SOAP DISHES

A. Fed. Spec. WW-P-541/8B, Type VI, Holder.

B. Class 1, Surface Mounted:
1. One piece with provisions for exposed fasteners.
2. Fabricate from chromium plated brass approximately 115 by 95 mm (4 1/2 by 3-3/4 inches) overall size with drainage openings at bottom.

C. Class 2, Recessed:
1. One piece seamless shell and flange with provisions for concealed fasteners.
2. Fabricate from either chromium plated brass, or 0.8 mm (0.0329 inch) thick stainless steel.
3. Form surface of soap tray with raised ridges or patterned dimples to provide gripping surface for soap bar, or provide flush soap tray with a retaining lip. Plastic soap trays or tray inserts are not acceptable.

2.14 MOP RACKS

A. Minimum 1.0M (40 inches) long with five holders.

B. Clamps:
1. Minimum of 1.3 mm (0.050-inch) thick stainless steel bracket retaining channel with a hard rubber serrated cam; pivot mounted to channel.
2. Clamps to hold handles from 13 mm (1/2-inch) minimum to 32 mm (1-1/4 inch) maximum diameter.

C. Support:
1. Minimum of 1 mm (0.0375 inch) thick stainless steel hat shape channel to hold clamps away from wall as shown.
2. Drill wall flange for 3 mm (1/8 inch) fasteners above and below clamp locations.

D. Secure clamps to support with oval head machine screws or rivets into continuous reinforcing back of clamps.

E. Finish on stainless Steel: AMP 503-No. 4.

2.15 STAINLESS STEEL SHELVES AT WHEELCHAIR LAVATORY

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

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

2.16 SHOWER SEATS

A. Wall mounted fold-up type:
   1. Normal capacity – min 250#
   2. Phenolic
   3. ADA compliant

PART 3 - EXECUTION

3.1 PREPARATION

A. Before starting work notify Resident Engineer in writing of any conflicts detrimental to installation or operation of units.

B. Verify with the Resident Engineer the exact location of accessories.

3.2 INSTALLATION

A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry.

C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.

D. Install accessories plumb and level and securely anchor to substrate.

E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.

F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.

G. Align mirrors, dispensers and other accessories even and level, when installed in battery.

H. Install accessories to prevent striking by other moving, items or interference with accessibility.

I. Install wall mirrors in Mental Health and Behavioral Units with tamper resistant screws that are flush mounted so that they will not support a rope or material for hanging.

3.3 CLEANING

A. After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

END OF SECTION

SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section covers recessed fire extinguisher cabinets.

1.2 RELATED WORK

A. Acrylic glazing: Section 08 80 00, GLAZING.

B. Field Painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

1.4 APPLICATION PUBLICATIONS

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

B. American Society of Testing and Materials (ASTM):
D4802-02 Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

A. Recessed type with flat trim of size and design shown.

B. Surface mounted where indicated.

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.

END OF SECTION

SECTION 10 51 13.01
METAL LOCKERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal lockers with hinged doors, hooks, latches, and hardware.

B. Base, top,end and filler panels.

C. Wood locker benches.

1.2 SUBMITTALS

A. Follow Section 01 33 00.

B. Shop Drawings: Show locker types, sizes, configurations, layout of groups of lockers, benches, accessories and numbering plan.

C. Product Data: Manufacturer's standard color charts.

D. Samples: 6 inch square (150 mm2) samples in selected color(s).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lyon Metal Products.

B. Penco Products Inc.

C. Republic Steel Corporation.

D. Or approved equal.

2.2 LOCKER TYPES AND ACCESSORIES

A. LK-1: Free standing double tier; size 12 inches (mm) wide x 12 inches (mm) deep x 60 inches (mm) high.
   1. Base Style: 30 inches high.
   2. Top Style: 30 inches width .
   3. Locking Device: Recessed locking handle for combination lock.
   4. Accessories: Number plate;twodoubleprong wall hooks; one double prong ceiling hook.

2.3 LOCKER MATERIALS AND FABRICATION

A. Fabricate lockers of mild, cold-rolled, leveled sheet steel, free from surface imperfections, of the following minimum thickness:
   1. Bodies and Shelves: 24 gauge.
   2. Doors: 16 gauge.
   3. Door Frames: 16 gauge.
   4. Hinges: 14 gauge.
   5. Base, Top, Trim: 22 gauge.

B. Bolts and Hooks: Zinc-plated or other rust-retarding treatment.

C. Bodies: Formed and flanged with stiffener ribs. Manufacturer's standard bolted construction.

D. Door Frame: Formed channel shape. Weld and grind flush. Vertical members shall provide a continuous door strike.

E. Doors: Channel reinforced top and bottom, with intermediate stiffener ribs. Provide three hinges for doors 42 inches (1067 mm) and higher, two for doors less than 42 inches (1067 mm) high. Weld hinges securely to body and rivet to door. Provide rubber silencers and other features to promote quiet operation. Locking device shall operate within channel formation of door.

F. Provide end panels, filler panels and sloped metal tops to close off openings.

G. Provide ventilation openings at top and bottom of each locker.

H. Finish edges smooth without burrs.

I. Finish: Manufacturer's standard baked enamel finishin color or colors as selected from standard range.

2.4 BENCHES

A. Bench Wood: Selected maple, oak or other acceptable hardwood. Shapes and sizes as shown; 1 1/4 inch (32 mm) thick minimum.

B. Finish: Sand bench tops smooth. Apply penetrating sealer and two coats of clear polyurethane varnish.

C. Bench Pedestal: Cast iron or steel tube frame. Finish to match lockers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lockers secure, plumb, square and in line. Set on prepared base provided.

B. Anchor lockers with appropriate devices to suit materials encountered.

C. Bolt adjoining lockers together to provide rigid installation.

D. Install end panels, filler panels, sloped tops and bases to completely close off openings.

E. Fasten bench pedestal to tops with wood screws and to floor with expansion type anchors.

F. Adjust doors, hardware and other moving or operating parts to function smoothly and correctly.

END OF SECTION

SECTION 10 71 13.01
EXTERIOR SUN CONTROL DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Custom exterior sunscreen including supporting members, fittings, and accessories.

1.2 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrications.

1.3 DESIGN AND PERFORMANCE CRITERIA

A. General:
   1. Design: Drawings indicate design intent only. Similar components that produce the desired architectural appearance will be permitted, provided that system proposed meets minimum standards shown and specified within limits of building dimensions and structural systems shown.

B. Structural:
   1. Design sunshades to accommodate local requirements for wind loads.
   2. Deflection and Tolerances: Design system to accommodate construction tolerances. Structural Steel Tolerances: AISC Code of Standard Practice, Section 7.
   3. Connections shall be designed by a Structural Engineer registered in the State California.

1.4 SUBMITTALS

A. Follow Section 01 33 00.01.

B. Shop Drawings: Submit construction drawings including plans, elevations, details, dimensions, anchoring, support steel sizing, and hardware, plates, and fittings. Include:
   1. Design loads used in structural calculations.
   2. Stamp or seal of design engineer.

C. Product Data: Submit manufacturer's product data, including specifications, and installation requirements from the manufacturer of the device. Show compliance with specified properties.

D. Samples:
   1. Submit 24 inches long of each material to be utilized with appropriate finish.
   2. Anodic Coatings: Show complete specified color range and AA designation number on sample.

E. Informational Submittals:
   1. Calculations: Signed and sealed by Professional Engineer registered in the State .
      a. Structural calculations.
      b. Seismic control calculations.
   2. Statement of qualifications for Manufacturer/Fabricator and Installer.

F. Operating and Maintenance Data: Manufacturer's instructions for installation.

1.5 QUALITY ASSURANCE

A. Systems Manufacturer, Fabricator and Installer: Company (or companies) with at least 5 years' successful experience in type and quality of work specified, which has completed a minimum of three projects incorporating similar systems. If installer is a separate company, installer shall be approved in writing by manufacturer/ fabricator.

B. Installer Qualifications: Manufacturer or authorized by manufacturer.

C. Pre-installation Meeting: Convene a pre-installation meeting two (2) weeks before start of installation. Require attendance of parties directly affecting work of this section. Review proper handling, preparation, installation, adjusting, cleaning, and coordination with other work.

D. Sunshade must be mechanically assembled. Welded construction is not acceptable. Blades must be removable for repair or replacement.

E. Sunshades must be purchased from a single source.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in accordance with manufacturer's instructions, in a clean, dry, well ventilated area, above ground on blocking, and do not allow materials to become wet, stained, or dirty.

C. Handle materials so as to protect materials, coatings, and finishes during handling and installation to prevent damage or staining. Handle in accordance with manufacturer's instructions.

1.7 WARRANTY

A. Provide manufacturer standard one year warranty.

B. Provide installer's written one year workmanship warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. DESIGN STANDARD MANUFACTURER: Construction Specialties, Inc.

B. Or Approved Equal. .

2.2 MATERIALS

A. Aluminum Extrusions, blades and outriggers: ASTM B211, Alloy 6063-T5.

B. Fasteners: Fasteners shall be aluminum or stainless steel. Provide types, gauges and lengths to suit unit installation conditions.

C. Anchors and Inserts: Use non-Ferrous metal anchors and inserts for installation and elsewhere as required for corrosion resistance. Use stainless steel expansion bolt devices for drill-in place anchors.

D. Supporting Steel Members: As specified in Section 05 12 00; all steel members hot-dipped galvanized after fabrication.

2.3 COMPONENTS

A. Components: All blades and outrigger components shall be 6063-T5 aluminum alloy.

1. Outriggers shall ¼" custom profile flat aluminum plate members, 6" high.
2. Blades shall be 6" high, longspan, extruded aluminum airfoil design. Blades shall be factory assembled to outriggers using stainless steel, type F, thread cutting screws through internal screw slots in blades. Welding is not acceptable. Blades to be mechanically secured to allow for replacement in case of damage. Fasters to be hexed head.
3. Sunshade system to be supplied with a 6" high Formed Channel Fascia.
4. Outriggers to be secured to steel "tabs" that are welded to the support steel tube. "Tabs" are to be provided and installed by the steel tube supplier.

2.4 COMPONENTS / FABRICATION

A. Provide fixed Sunshades and accessories of design, material, sizes, depth, arrangement, and thickness as indicated or as required for optimal performance with respect to strength; durability; and uniform appearance.

B. Include supports, anchorage and accessories required for complete assembly.

2.5 FINISH, ALUMINUM

A. Comply with NAAMM "Metal Finishes Manual" for finish designation and application recommendation, except as otherwise indicated. Apply finishes in factory after product assembly. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces which will be visible after completing finishing process.

B. Anodized clear or as selected by architect from manufacturers stand Kynar colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive sun control device. Notify Contractor if area is not acceptable. Do not begin installation until unacceptable conditions have been corrected.

B. Examine anchorage for location and elevation. Notify Contractor of inaccuracies. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation of the work.

B. Verify dimensions of supporting structure by field measurement for work to be accurately designed, fabricated and fitted to the structure.

C. Anchor sunscreen to building substructure as indicated on architectural drawings and approved shop drawings.

D. Erection tolerances:
   1. Variation from level: plus or minus 1/8 inch maximum in any column to column space or 20 foot runs, non cumulative.
   2. Offsets in end-to-end or edge-to-edge alignment of consecutive members 1/32 inch.

E. Cut and trim component parts during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly, as directed.

F. Ensure surfaces are smooth, uniform, and clean, with even curved edges and interfaces, and with no cuts, scratches, abrasions, stains, marks, blemishes, or connection irregularities. Do not erect warped, bowed, deformed or otherwise damaged or defaced units. Remove and replace damaged units as directed.

G. Install level, plumb, and true to line, with uniform joints.

END OF SECTION

SECTION 10 73 13.01
AWNINGS AND CANOPIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Description of system:
   1. Work in this section includes furnishing and installation os extruded aluminum overhead hanger rod style canopies.
   2. Related items and considerations
      a. Flashing of various designs may be required. Supplied by the installer.
      b. Determine wall construction, make-up and thickness.
      c. Ensure adequate wall condition to carry canopy loads where required.
      d. Consider water drainage away from canopy where necessary.

1.2 QUALITY ASSURANCE

A. Design criteria:
   1. Design to support minimum 30 PSF live loading.
   2. Design system to withstand 75 MPH winds.

B. Applicator/erector qualifications:
   1. Minimum of 5 years experience fabricating and installing like systems.

C. Products meeting these specifications established standard of quality required.

1.3 FIELD MEASUREMENTS

A. Confirm dimensions prior to preparation of shop drawings.

B. If requested, supply manufacturer's standard literature and specification for canopies.

C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

1.4 PERFORMANCE REQUIREMENTS

A. Canopy must conform to local building codes.

B. Determine is specific load requirements have been established for canopies and if stamped calculations are required for location in which canopy is installed.

1.5 SUBMITTALS

A. Shop drawings:
   1. Detailed; for entire system.

B. Samples:
   1. For color selection.

C. Project information:
   1. Manufacturer's installation instructions and recommendations.
   2. Certification of installer qualifications.

D. Contract closeout information:
   1. Warranty.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver pre-assembled units in maximum possible sizes.

B. Store and handle to preclude damage.

1.7 WARRANTY

A. Warrant color fastness and structural integrity for 5 years.

B. Warranty signed jointly by manufacturer, installer and Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable manufacturers:
   1. Awnings and canopies, framing system:
      a. Base: Mapes Canopies.
   2. Or approved equal.

B. Materials:
   1. Decking and fascia shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown.
   2. Decking shall be 2-3/4" extruded .078" decking.
   3. Hanger rods and attachment hardware shall be powder coated to match canopy.
   4. Fascia shall be standard 8" extruded "G" style (minimum .125 aluminum).

C. FInishes:
   1. Standard factory options are clear anodized, bronze baked enamel or white baked enamel.
   2. Optional finishes include powder coating and standard two-coat Kynar colors.

2.2 FABRICATION

A. All connections shall be mechanically assembled utilizing 3/16" fasteners with a minimum shear stress of 350 lbs. Pre-welded or factory-welded connections are not acceptable.

B. Decking shall be designed with interlocking extruded aluminum members with mechanical fasteners field applied to provide structural integrity for the completed assembly.

C. Concealed drainage. Water shall drain from the covered surfaces into integral fascia gutter and directed to either the front for front drainage or to the rear for ground level discharge via one or more designated downspouts.

PART 3 - EXECUTION

3.1 INSPECTION

A. Confirm that surrounding area is ready for the canopy installation.

B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by manufacturer.

C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.

3.2 PREPARATION

A. Correct unsatisfactory substrates prior to start of work.

3.3 INSTALLATION

A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handing and erection.

3.4 ADJUSTMENT/CLEANING

A. Just prior to completion, clean as required.

END OF SECTION

SECTION 11 53 43.01
LABORATORY SERVICE FITTINGS AND FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Laboratory valves and related components.

B. Laboratory emergency plumbing fixtures.

C. Emergency shower tempering system.

D. Hose reel assemblies.

E. Ice Maker Hook Up.

F. Recessed Valve Box.

1.2 REFERENCES

A. Conform to the recommended practices for laboratory service fittings and fixtures published by the Scientific Equipment and Furniture Association (SEFA) 7: Fixtures, current version.

B. All emergency plumbing fixtures shall comply with requirements of ANSI Standard Z358.1: American National Standard for Emergency Eyewash and Shower Equipment, current edition.

C. Where identified, service fittings and sinks shall be accessible to the disabled in compliance with the requirements of the federal Americans with Disabilities Act (ADA), ADA Accessibility Guidelines (ADAAG), and state accessibility regulations.

D. All emergency plumbing fixtures shall be accessible to the disabled in compliance with the requirements of the federal Americans with Disabilities Act (ADA), ADA Accessibility Guidelines (ADAAG), and state accessibility regulations.

1.3 DESCRIPTION

A. Work includes but is not necessarily limited to furnishing to the project site for installation by Division 22, all laboratory fittings, emergency plumbing fixtures, and fixtures described herein and shown on the Drawings. When specified, Division 26 shall install associated electrical work associated with emergency equipment.

1.4 SUBMITTALS

A. Submit as specified herein and under provisions of Section 01 33 00.

B. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment, and products for Work in this Section.

C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, dimensions, details and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducibles or photocopies, not to exceed 11inches by 17 inches (A3) in size. Blueline prints are not acceptable.

D. Samples: Submit two (2) samples of each type of specified finish and color specified.

E. Operations/Maintenance Manuals: Submit under provisions of Section 01 77 00 complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, and nearest local factory representative for components and repairs.

1.5 QUALIFICATIONS

A. Work of this Section shall be performed by an organization with five years documented experience specializing in the manufacture of the type of equipment specified, with demonstrated ability to produce the specified equipment of the required quality and quantity for complete installation in a project of this type and size within the required time limits. Upon request, manufacturers shall produce evidence of financial stability and bonding capacity required to perform on this project.

B. Work in this Section requires close coordination with Work in Section 12 35 53, Division 22 Plumbing, Division 23 HVAC and Division 26 Electrical. Coordinate all Work to assure an orderly progress in the Project, without removal of previously installed Work, and so as to prevent damage to finishes and products.

C. Review conditions of installation, procedures and coordination with related Work.

D. Carefully inspect the installed Work specified in other Sections and verify that all such Work is complete and ready for the installation of this Work to properly commence.

E. Verify that all Work may be installed in complete accordance with the original design, reviewed submittals and manufacturer's recommendations.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver all fittings and fixtures to job site in recommended packaging, with each fitting individually packaged, marked, and scheduled for point of use.

B. Inventory fittings, at job site, verify that type and quantity are correct, and re-package until installed.

C. Store in clean, dry location.

PART 2 - PRODUCTS

2.1 GENERAL

A. All service fittings and emergency plumbing fixtures shall be specifically designed for laboratory use.

B. All service fittings and emergency plumbing fixtures shall be factory pre-assembled including the assembly of valves to turrets, mounting shanks to turrets, etc., and individually factory tested.

C. All laboratory service fittings shall be the product of one service fitting manufacturer to assure ease of replacement and maintenance.

D. All emergency plumbing fixtures shall be the product of one manufacturer to assure ease of replacement and maintenance.

E. All service valves, fittings, and accessories shall be of cast brass with a minimum copper content of 85 percent, except for items which are to be brass forging or bar stock, or are specifically specified to be of another material.

F. Provide fittings at locations indicated on the Laboratory Furnishings drawings. Refer to Service Fitting Schedule for types.

G. Assembly components and operating parts such as valve stems, renewable units, packing nuts, outlet nozzles and straight serrated hose ends shall be made from solid brass stock.

H. Replaceable seats, needle cones, valve disc screws and other accessories shall be Monel or stainless steel alloys especially selected for use intended.

I. Fittings shall be factory tested and shall be supplied with nipples, lock nuts, shanks, etc.

J. Serrated tip fittings shall have 3/8 inch (9.525mm) IPS thread with the hose end being tapered. Diameter of orifice in serrated tip shall be 1/8 inch (3.2mm), except where otherwise specified.

K. Turrets shall be brass drop forging of design indicated in details shown elsewhere in the Section and shall be one or two-way, as required, with 3/8 inch (9.525mm) IPS female inlet thread for connections. Units shall be furnished with brass shanks, brass locknuts, and washers.

L. Fittings located on the same plane shall have their handles project the same distance from the plane of reference to present a uniform related appearance, regardless of valve type construction.

M. Flanges shall be brass forging of approved design with 3/8 inch (9.525mm) IPS female inlet and outlet.

N. All fittings shall have plastic colored service index buttons as specified in this Section.

O. Provide plug and socket (2-piece) quick connect service fittings, as manufactured by Swagelok Company website: http://www.swagelok.com/ tel: 440 248-4600., Hansen Manufacturing (Air-Oil Systems, Inc.) website: http://www.airoil.com/ tel: 800 333-5520., or Tomco Products, Inc. website: http://www.tomcoquickcouplers.com/ tel: 864 574-7966, or as manufactured by the remainder of the laboratory fittings, or approved equal, for all chilled water supply and return fittings, compressed air fittings for pressures greater than 30 psi (2 bar), and other services as indicated in this Section and on the Laboratory Equipment Drawings.

P. Fittings and fixtures designated to be accessible to the disabled (ADA) with operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N), maximum.

2.2 LABORATORY SERVICE FITTINGS

A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory service fittings specified in this section shall be provided by a single manufacturer.
   1. Water Saver Faucet Co., 701 West Erie Street, Chicago, IL 60610 Tel: 312 666-5500. website: http://www.wsflab.com/.
   2. T&S Brass and Bronze Works, Inc., 2 Saddleback Cove, P. O. Box 1088, Travelers Rest, SC 29690 Tel: (800) 476-4103. - website: http://www.tsbrass.com/ .
   3. The Chicago Faucet Company, 2100 S. Clearwater Dr., Des Plaines, IL 60018-5999 Tel: 847-803-5000. website: http://www.chicagofaucets.com
   4. Delta Faucet Company (USA), 55 E. 111th Street, PO Box 40980, Indianapolis, IN 46280 Tel: 317 817-1812. website: http://www.deltafaucet.com/.
   5. Or Approved Equal.

B. Body Style: All service fittings shall have traditional body profiles (cylindrical and tapered). Mushroom-profile body styles are not allowed. Turrets shall be provided without deck flanges.

C. Handles:
   1. Laboratory gas, air and vacuum valves at workstations indicated to be accessible to the disabled (ADA): Provide ball valves fitted with lever-type handles and screw on index (identification) discs.
   2. Other fittings shall be fitted with four arm handles.

D. Finish: Polished chrome, with clear, acid-resistant (epoxy) coating.

E. Needle Valves: Fully assembled and factory tested at 225 psi (1.55 mPa) air pressure. Gas, air, vacuum and steam needle valve fittings shall have stainless steel replaceable floating cone that is precision ground and self-centering which shall seat against a stainless steel or monel renewable valve seat. Valve shall be for standard control under pressure up to 150 psi (1.03 mPa) and shall have subject-to-wear parts easily replaceable. Provide pressure regulators designed for use with the appropriate service at locations indicated on the Laboratory Furnishing drawings.
   1. G1: Wall/panel-mounted, single angle pattern, needle valve: Water Saver L3180-158WSA, or approved equal, as specified herein:
      a. Exposed metal shall be finished as specified elsewhere in this Section.
      b. Four-arm handle with colored plastic index button.
      c. Wall mounting flange. Flange shall be threaded in a manner to be installed tight to wall surface in wall mounted applications, and allow fitting to be installed straight.
      d. Serrated hose end.
      e. Mounting shank.
      f. Length of valve from wall to index button shall be 5-1/2 inches (140mm), nominal.

2.3 LABORATORY SAFETY EQUIPMENT

A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory safety fixtures specified in this section shall be provided by a single manufacturer.
   1. Water Saver Faucet Co., 701 West Erie Street, Chicago, IL 60610 Tel: 312 666-5500. website: http://www.wsflab.com/.
   2. Haws Drinking Faucet Co., 1435 Fourth Street, PO Box 1999, Berkeley, CA 94701 Tel: 510 525-5801. website: http://www.hawsco.com/.
   3. Guardian Equipment, 660 N. Union St., Chicago, IL 60610 Tel: 312 733-2626. website: http://www.gesafety.com/.
   4. Or Approved Equal.

B. General: Laboratory safety equipment shall be certified in accordance with ANSI Z358.1-2004.

C. Barrier-free safety station with swing-down eye/face wash and emergency shower actuation valve in stainless steel cabinet for recess mounting: Water Saver Model No. SSBF2152, or approved equal, with the following characteristics or modifications.
   1. Ceiling-mounted exposed showerhead. Nipple length shall be as required for a complete installation; verify finished ceiling height.
   2. Exposed piping, showerhead, nipple, and escutcheon shall be stainless steel.
   3. Safety shower actuating arm shall be stainless steel.
   4. Showerhead shall have perforated stainless steel spreader.
   5. Eyewash heads shall have individually adjustable flow control and filter to remove impurities from water.
   6. Eyewash flow shall be activated by swing-down actuation valve connected to eyewash piping.
   7. Eyewash component is housed in a 16 gauge stainless steel combination cover and drain pan. While unit is on operation, water flows through spray heads and waste water is collected in drain pan and returned into cabinet for drainage.
   8. Waste water drains out through the cabinet through a 1-1/2 INCH outside diameter tailpiece with a stainless steel cover.
   9. Eyewash components and safety shower actuating arm shall be mounted in a flanged, recessed-mounted 16 gauge (1.3mm) stainless steel cabinet with No. 4 finish.
   10. Stay-open brass ball valves concealed behind stainless steel/access panel housing.
   11. Fixture shall be furnished with green plastic sign with graphic symbol for safety shower/eyewash.

2.4 FINISHES

A. Chrome finish with clear, acid-resistant coating:
   1. Applicable to:
      a. All laboratory service fittings.
      b. All laboratory service fittings mounted on stainless steel work surfaces, scullery sinks, hand or service sinks, or any other stainless steel laboratory furnishing item or equipment.
   2. Chrome finish: All exposed surfaces shall be polished and buffed, then electroplated with one layer of nickel and one layer of chrome. Each layer of plating shall completely cover all visible areas. Total plating thickness shall be not less than 0.4 mil (10 µm). Finish:
      a. Polished.
   3. Clear epoxy coating: Following plating, clear epoxy coating shall be applied to all exposed surfaces and then baked to permit curing. Surfaces shall have a minimum coating thickness of 2 mils (50 µm).

B. Performance requirements for coated finishes:
   1. Chemical resistance:
      a. Fume Test: Suspend coated samples in a container of at least 6 cu. ft. (170 l) capacity, approximately 12 inches (300mm) above open beakers, each containing 100 ml of 70 percent nitric acid, 94 percent sulfuric acid and 35 percent hydrochloric acid, respectively. After exposure to these fumes for 150 hours, the finish on the samples shall show no discoloration, disintegration or other effects.
      b. Direct Application Test: Subject coated samples to the direct action of the following reagents and solvents at a temperature of 25 degrees C dropping from a burette at the rate of 60 drops per minute for ten minutes. Finish on samples shall not rupture, though slight discoloration or temporary softening is permissible.

Reagent	Concentration
Acetic Acid	98%
Acetone	
Ammonium Hydroxide	28%
Amyl Acetate	
Amyl Alcohol	
Benzene	
Butyl Alcohol	
Calcium Hypochlorite	
Carbon Disulfide	
Carbon Tetrachloride	
Chloroform	
Chromic Trioxide Acid	
Cresol	
Crude Oil	
Dioxane	
Distilled Water	
Ether	
Ethyl Acetate	
Ethyl Alcohol	
Ethyl Ether	
Formaldehyde	37%
Formic Acid	90%
Gasoline	
Glacial Acetic Acid	99.5%
Glycerine	

Reagent	Concentration
Hydrochloric Acid	38%
Hydrofluoric Acid	48%
Hydrogen Peroxide	5%
Isopropyl Alcohol	
Lactic Acid	10%
Kerosene	
Methanol	
Methyl Alcohol	
Methyl Ethyl Ketone	
Methylene Chloride	
Mineral Oil	
Monochlor Benzene	
N-Hexane	
Naphthalene	
Nitric Acid	70%
Perchloric Acid	70%
Phenol	
Phosphoric Acid	75%
Sea Water	
Silver Nitrate	30%
Sodium Bichromate	saturated
Sodium Carbonate	10%
Sodium Chloride	20%
Sodium Hydroxide	50%
Sodium Hypochlorite	
Sodium Sulfide	
Sulfuric Acid	87%
Toluene	
Trichlorethylene	
Turpentine	
Urea	saturated
Xylene	
Zinc Chloride	saturated

2. Mar and abrasion resistance: Coating material shall have a pencil hardness of 2H – 4H with adhesion substantial enough to withstand both direct and reverse impacts of 160 inch-pounds (18 Nm). Coating shall have excellent mar resistance and be capable of withstanding scuffing, marring and other ordinary wear.
3. Repairability: Scratches and other localized surface damage shall be field-repairable.

2.5 EMERGENCY SHOWER TEMPERING SYSTEM

A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers.
   1. Guardian Equipment, 660 N. Union St., Chicago, IL 60610 Tel: 312 733-2626. website: http://www.gesafety.com/.
   2. Haws Drinking Faucet Co., 1435 Fourth Street, PO Box 1999, Berkeley, CA 94701 Tel: 510 525-5801. website: http://www.hawsco.com/.
   3. Encon Safety Products, 6825 W. Sam Houston Pkwy. N., Houston, TX 77041 Tel: 800 283-6266. website: http://www.enconsafety.com/.
   4. Or Approved Equal.

B. Thermostatic mixing valve and recessed stainless steel cabinet with door and lock for emergency shower and safety station: Connections for hot and cold water inlets. Delivered water temperature range 60 degrees F (15 degrees C) to 90 degrees F (32 degrees C). Initial setting to be 85 degrees F (29 degrees C) unless otherwise instructed by Architect. Guardian Equipment G3807, or approved equal.

2.6 HOSE REEL ASSEMBLY

A. Description: Wall mounted hose reel complete with reel, hose, spray nozzle and mixing station

B. Manufacturers: Products that comply with this specification section as judged and approved by the Architect may be provided by the manufacturers listed herein.

C. Hose Reel:
   1. Manufacturers:
      a. Strahman Valves, Inc., 2801 Baglyos Circle, Lehigh Valley Industrial Park VI, Bethlehem, PA 18020 Tel: 484 893-5080.
      b. Armstrong International, 816 Maple Street, Three Rivers, MI 49093 Tel: 269 273-1415.
      c. Reelcraft, One Reelcraft Center, P.O. Box 248, Columbia City, IN 46725 Tel: 260 248-8188.
      d. Nederman, Inc., 39115 Warren Road, Westland, MI 48185 Tel: 734-729-3344.
      e. Or Approved Equal.
   2. Description:
      a. Spring retractable hose reel for wall mounting.
      b. Polished, Type 304 stainless steel construction.
      c. Heavy duty hose bracket with nylon guide rollers.
      d. Weatherproof spring.
      e. Heavy-duty, automatic spring motor assembly. Permanent factory lubricated reel.
      f. Ratchet mechanism to maintain the desired length of hose.
      g. Wall bracket.
      h. Solid molded rubber adjustable hose bumper with stainless steel hardware.
   3. Operation: Hose shall maintain position until a slight tug causes it to retract automatically.

D. Mixing Valve:
   1. Manufacturers:
      a. Strahman Valves, Inc., 2801 Baglyos Circle, Lehigh Valley Industrial Park VI, Bethlehem, PA 18020 Tel: 484 893-5080.
      b. Armstrong International, 816 Maple Street, Three Rivers, MI 49093 Tel: 269 273-1415.
      c. Leonard Valve Company, 1360 Elmwood Avenue, Cranston, RI 02910 Tel: 401 461-1200.
      d. Or Approved Equal.
   2. Description:
      a. Stainless steel panel for recessed flush wall mounting with flange.
      b. Nominal Dimensions: 14 inches wide x 22 inches high x 5-3/4 inches deep.
      c. 3/4 inch hot and cold water inlets.
      d. Valve Construction: Bronze. Exposed arts shall be stainless steel or chrome-plated bronze.
      e. Unit shall be provided without hose rack.
      f. Mixing Valve.
      g. Thermometer.
      h. Threaded connection with backflow preveneter for hose to supply water to hose reel.

E. Hose:
   1. Manufacturers:

a. Strahman Valves, Inc., 2801 Baglyos Circle, Lehigh Valley Industrial Park VI, Bethlehem, PA 18020 Tel: 484 893-5080.
b. Armstrong International, 816 Maple Street, Three Rivers, MI 49093 Tel: 269 273-1415.
c. Leonard Valve Company, 1360 Elmwood Avenue, Cranston, RI 02910 Tel: 401 461-1200.
d. Reelcraft, One Reelcraft Center, P.O. Box 248, Columbia City, IN 46725 Tel: 260 248-8188.
e. Nederman, Inc., 39115 Warren Road, Westland, MI 48185 Tel: 734-729-3344.
f. Or Approved Equal.

2. Description:
a. 5/8 inch inside diameter hose.
b. Length: 50 feet.
c. Maximum Working Pressure: 150 psi (10 Bar).
d. Maximum Operating Temperature: 180 degrees F (82 degrees C).
e. Hose shall be white or off-white, neoprene covered, premium-wrapped hose.
f. Hose shall be provided with bronze, bronze-plated chrome, or stainless steel fittings.
g. Provide additional hose from mixing valve to hose reel.

F. Nozzle:
1. Manufacturers:
a. Strahman Valves, Inc., 2801 Baglyos Circle, Lehigh Valley Industrial Park VI, Bethlehem, PA 18020 Tel: 484 893-5080.
b. Armstrong International, 816 Maple Street, Three Rivers, MI 49093 Tel: 269 273-1415.
c. Leonard Valve Company, 1360 Elmwood Avenue, Cranston, RI 02910 Tel: 401 461-1200.
d. Nederman, Inc., 39115 Warren Road, Westland, MI 48185 Tel: 734-729-3344.
e. Or Approved Equal.

2. Description:
a. Valve Construction: Rubber-coated bronze with adjustable spray setting. Internal parts shall be bronze, brass, or stainless steel.
b. Maximum Operating Temperature: 180 degrees F (82 degrees C).
c. Maximum Working Pressure: 150 psi (10 Bar).
d. Color: White.

2.7 ICE MAKER HOOK-UP

A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers.
1. IPS Corporation, 202 Industrial Park Lane, Collierville, TN 38017 Tel: 800 888-8312.
2. Or Approved Equal.

B. Basis of Design: IPS Guy Gray Model MIB 1 wall recessed ice maker hook-up, or equal.

C. Recessed wall box and faceplate shall be fabricated of 20 gauge steel with white powder coated finish. Approximate overall dimensions: 11-5/8 inches wide by 9-1/2 inches high by 3-1/2 inches deep.

D. Box shall be equipped with 1/4 inch compression angle valve and with 1/2 inch soldered connection.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Inspection:

1. Prior to installation of fixtures specified in Section 11 53 43, carefully inspect the installed Work specified in other Sections and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that all Work has been installed in complete accordance with the original design, approved submittals, and the manufacturer's recommendations.

B. Discrepancy:
1. In the event of discrepancy, immediately notify the Architect.

C. Installation:
1. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.
2. Install fixtures plumb and level.
3. Provide piping connections to fixtures with valves and escutcheons as specified in Division 22.
4. Verify that fixtures and trim are tight, leak-free and function properly

3.2 INSTALLATION

A. Set internal volume control on all cup sink water fittings so water does not splash out of sink.

B. Set sinks in chemical resistant sealing compound, secure and support, as recommended by the manufacturer.

C. Emergency Showers:
1. Emergency showers must be installed with a minimum of 16 inches (407mm) of clearance from any obstruction to the center of the showerhead (eyewash or eye/face wash fixture is not considered an obstruction).
2. In all cases, emergency showers shall be installed with showerhead positioned not lower than 82 inches or above 96 inches (2083mm or above 2438mm) measured from the operational standing surface. Refer to drawings for mounting height within that range. If no range is provided, shower head shall be installed 96 inches (2438mm) above the operational standing surface.

END OF SECTION

SECTION 13 05 41
SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.

B. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:
   1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; and storage racks.
   2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems.
   3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler equipment and components.
   4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

1.2 RELATED WORK

A. Section No. 03 30 00 Cast-in-place Concrete

B. Section No. 23 05 41 Noise and vibration Control for HVAC Piping and Equipment

C. Section No. 05 40 00 Cold-Formed Metal Framing

D. Section No. 14 21 00 Electric Traction Elevators

1.3 QUALITY CONTROL

A. Shop-Drawing Preparation:
   1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the state of California.
   2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State or California.

B. Coordination:
   1. Do not install seismic restraints until seismic restraint submittals are approved by the Resident Engineer.
   2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

1.4 SUBMITTALS

A. Submit a coordinated set of equipment anchorage drawings prior to installation including:

1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
3. Numerical value of design seismic brace loads.
4. For expansion bolts, include design load and capacity if different from those specified.

B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:
1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
3. Pipe contents.
4. Structural framing.
5. Location of all gravity load pipe supports and spacing requirements.
6. Numerical value of gravity load reactions.
7. Location of all seismic bracing.
8. Numerical value of applied seismic brace loads.
9. Type of connection (Vertical support, vertical support with seismic brace etc.).
10. Seismic brace reaction type (tension or compression). Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.

C. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:
1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
3. Maximum spacing of hangers and bracing.
4. Seal of registered structural engineer responsible for design.

D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.

E. Submit for concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

1.5 APPLICABLE PUBLICATIONS:

A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):

355.2-07	Qualification for Post-Installed Mechanical Anchors in Concrete and Commentary

C. American Institute of Steel Construction (AISC): Load and Resistance Factor Design, Volume 1, Second Edition.

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

A36/A36M-05	Standard Specification for Carbon Structural Steel.
A53/A53M-07	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
A307 (REV A-07)	Standard Specification for Carbon Steel Bolts and Studs; 60,000 PSI Tensile Strength.

A325-07	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
A325M-05	Standard Specification for High-Strength Bolts for Structural Steel Joints [Metric].
A490-06	Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
A490M (REV A-04)	Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric].
A500/A500M-07	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
A501-07	Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
A615/A615M-07	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
A992/A992M (REV A-06)	Standard Specification for Steel for Structural Shapes for Use in Building Framing.
A996/A996M (REV A-06)	Standard Specification for Rail-Steel and Axel-Steel Deformed Bars for Concrete Reinforcement.
E488-96(R2003)	Standard Test Method for Strength of Anchors in Concrete and Masonry Elements.

E. International Building Code (CBC) 2010 Edition.

F. VA Seismic Design Requirements, H-18-8, December 2003.

G. National Uniform Seismic Installation Guidelines (NUSIG).

H. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

I. Seismic Restraint Manual - Guidelines for Mechanical Systems, 1998 Edition and Addendum.

1.6 REGULATORY REQUIREMENT

A. CBC 2010.

B. Exceptions: The seismic restraint of the following items may be omitted:
   1. Equipment weighing less than 400 pounds, which is supported directly on the floor or roof.
   2. Equipment weighing less than 20 pounds, which is suspended from the roof or floor or hung from a wall.
   3. Gas and medical piping less than 2 ½ inches inside diameter.
   4. Piping in boiler plants and equipment rooms less than 1 ¼ inches inside diameter.
   5. All other piping less than 2 ½ inches inside diameter, except for automatic fire suppression systems.
   6. All piping suspended by individual hangers, 12 inches or less in length from the top of pipe to the bottom of the support for the hanger.
   7. All electrical conduits, less than 2 ½ inches inside diameter.
   8. All rectangular air handling ducts less than six square feet in cross sectional area.
   9. All round air handling ducts less than 28 inches in diameter.
   10. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of support for the hanger.

PART 2 - PRODUCTS

2.1 STEEL

A. Structural Steel: ASTM A36.

B. Structural Tubing: ASTM A500, Grade B.

C. Structural Tubing: ASTM A501.

D. Steel Pipe: ASTM A53/A53M, Grade B.

E. Bolts & Nuts: ASTM A307, ASTM A325 .

2.2 CAST-IN-PLACE CONCRETE

A. Concrete: 28 day strength, f'c = 25 MPa (3,000 psi).

B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

PART 3 - EXECUTION

3.1 CONSTRUCTION, GENERAL

A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.

B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.

C. Construct seismic restraints and anchorage to allow for thermal expansion.

D. Testing Before Final Inspection:
   1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
   2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

3.2 EQUIPMENT RESTRAINT AND BRACING

A. All equipment not excluded by 1.6 B shall be anchored and supported for the combined effects of seismic forces and self weight. The controlling load combinations as outlined in ASCE 7-05 shall be considered.

3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS

A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).

B. Brace duct and breeching branches with a minimum of 1 brace per branch.

C. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.

D. Seismic Restraint of Piping:
   1. Design criteria:

a. Seismic restraint for piping shall follow the force levels shown in table 3.1 or as calculated by formulas in ASCE 7-05. All pipes shall be considered full with water for calculation of self weight and seismic mass.

E. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

TABLE 3.1 Seismic Force levels for Seismic Bracing

All Distribution Systems and equipment below shall have anchorage and bracing designed for a lateral load equal to 100% of self weight, Items not specifically listed below shall be designed to 150% of self weight
DISTRIBUTION SYSTEMS
Piping in accordance with ASME B31, including in-line components with joints made by welding or brazing.
Piping in accordance with ASME B31, including in-line components, constructed of high or limited deformability mat'ls, w/ joints made by threading, bonding, compression or grooved couplings.
Piping and tubing not in accordance with ASME B31, including in-line components, constructed of high-deformability materials, with joints made by welding or brazing.
Piping & tubing constructed of low-deformability mat'ls, such as cast iron, glass, and nonductile plastics. limited-deformability mat'ls, w/ threading, bonding, compression or grooved coupling joints.
Ductwork, including in-line components, constructed of high- or limited-deformability materials w/ joints made by means other than welding or brazing.
Electrical conduit, bus ducts, rigidly mounted cable trays, and plumbing.
Suspended cable trays.
Air-side HVAC, fans, air handlers, ac units, cabinet heaters, air distribution boxes, and other mechanical components constructed of sheet metal framing.
Wet-side HVAC, boilers, furnaces, atmospheric tanks and bins, chillers, water heaters, heat exchangers, evaporators, air separators, manufacturing or process equipment, and other mechanical components constructed of high-deformability materials.
EQUIPMENT
Engines, turbines, pumps, compressors, and pressure vessels
Elevator and escalator components.
Generators, batteries, inverters, motors, transformers, and other electrical components constructed of high deformability materials.
Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing.
Communication equipment, computers, instrumentation, and controls.
Roof-mounted chimneys, stacks, laterally braced
Lighting fixtures.
All Vibration Isolated components listed below shall have anchorage and bracing to resist a lateral load equal to 270% of self weight.
VIBRATION ISOLATED COMPONENTS AND SYSTEM
Components and systems isolated using neoprene elements and neoprene isolated floors with built-in or separate elastomeric snubbing devices or resilient perimeter stops.
Spring isolated components and systems and vibration isolated floors closely restrained using built-in or separate elastomeric snubbing devices or resilient perimeter stops.
Internally isolated components and systems.
Suspended vibration isolated equipment including in-line duct devices and suspended internally isolated components.

3.4 PARTITIONS

A. In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.

B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

3.5 CEILINGS AND LIGHTING FIXTURES

A. At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.

B. Independently support and laterally brace all lighting fixtures. Refer to applicable portion of lighting specification, Section 26 51 00, INTERIOR LIGHTING.

3.6 FACADES AND GLAZING

A. Do not install concrete masonry unit filler walls in a manner that can restrain the lateral deflection of the building frame. Provide a gap with adequately sized resilient filler to separate the structural frame from the non-structural filler wall.

B. Tie brick veneers to a separate wall that is independent of the steel frame as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

C. Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

3.7 STORAGE RACKS, CABINETS, AND BOOKCASES

A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.

B. Anchor supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.

C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.

D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

END OF SECTION

SECTION 14 21 00
ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Electric Traction Elevators.

B. Products Supplied But Not Installed Under this Section:
1. Hoist Beam
2. Pit Ladder

C. Work Supplied Under Other Sections:
1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
2. Hoistway ventilation shall be in accordance with local and national building code requirements.
3. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
4. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
5. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502.
6. Provide a minimum of 2 at the top, front of each hoistway.
7. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
8. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.
9. Access Doors: As required for access to governor. Access door shall be self-closing, self-locking if necessary and operable from the inside without a key.

D. Related sections:

1. Section 033000 - Cast-in-Place Concrete:
2. Section 055000 - Metal Fabrications
3. Division 23 - Heating, Ventilating, and Air Conditioning
4. Division 26 - Electrical
5. Division 27 - Communications
6. Section 283100 - Fire Detection and Alarm
7. Division 31 - Earthwork

E. Industry and government standards:

1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
2. ADAAG - Accessibility Guidelines for Buildings and Facilities
3. ANSI/NFPA 70, National Electrical Code
4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows

5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

1.2 DESCRIPTION OF ELEVATOR (BASIS OF DESIGN)

A. Elevator Equipment: KONE EcoSpace™ gearless traction elevator

B. Equipment Control: KCM831

C. Quantity of Elevators: 2

D. Landings: 2

E. Openings: 2 Front Openings, 0 Back Openings

F. Travel: 15'-0"

G. Rated Capacity: 5000 lbs (2268 kg) Service shape

H. Rated Speed: 150 fpm

I. Clear Inside Dimensions (W x D): 5'-6 13/16" x 8'-9 3/16"

J. Cab Height: 9'

K. Clear height under suspended ceiling: 7'-7"

L. Entrance Width & Type: & Right/Left Openings

M. Entrance Height: 7'

N. Main Power Supply: 480 Volts + 5%, three-phase

O. Operation: Both Simplex

P. Machine Location: Inside the hoistway mounted on car guide rail

Q. Control Space Location: Remote Closet

R. Elevator Equipment shall conform to the requirements of seismic zone: Seismic

S. Maintenance Service Period: 12 Months

1.3 PERFORMANCE REQUIREMENTS

A. Car Performance
1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.
2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

B. System Performance
1. Vertical Vibration (maximum): 25 mg
2. Horizontal Vibration (maximum): 25 mg
3. Jerk Rate (maximum): 1.3 ft/sec3
4. Acceleration (maximum) 1.3 ft/sec2
5. In Car Noise: = 55 dB(A)
6. Leveling Accuracy: ±0.2 inches
7. Starts per hour (maximum): 120

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product literature for each proposed system.
1. Cab design, dimensions and layout.
2. Layout, finishes, and accessories and available options.

3. Controls, signals and operating system.
4. Color selection charts for cab and entrances.

B. Shop Drawings:
1. Clearances and travel of car.
2. Clear inside hoistway and pit dimensions.
3. Location and layout of equipment and signals.
4. Car, guide rails, buffers and other components in hoistway.
5. Maximum rail bracket spacing.
6. Maximum loads imposed on building structure.
7. Hoist beam requirements.
8. Location and sizes of access doors.
9. Location and details of hoistway door and frames.
10. Electrical characteristics and connection requirements.

C. Operation and maintenance data:
1. Provide manufacturer's standard maintenance and operation manual.

1.5 QUALITY ASSURANCE

A. Manufacturer: Minimum of ten years experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.

B. Installer: The equipment manufacturer shall install the elevator.

C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.6 DELIVERY, STORAGE AND HANDLING

A. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional labor costs for double handling will be the responsibility of the general contractor.

B. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.7 WARRANTY

A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.8 MAINTENANCE SERVICE

A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 Months after date of substantial completion. Replacement parts shall be produced by the original equipment manufacturer.

B. Maintenance service be performed during regular working hours of regular working days and shall include emergency 24-hour call back service.

C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:
   1. Basis of Design: EcoSpace™ traction elevators by KONE, Inc. (www.kone.com).
   2. Other acceptable machine room-less products:
      a. Otis Elevator Co. - Gen2™ Product
      b. Schindler Elevator Corp. - 400A Product
      c. Or approved equal

2.2 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microcomputer based control system to perform all of the functions.
   1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.
   2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
   3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.
   4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.

B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.

C. Controller Location: Within 100'-0" (30.48m) Controller(s) shall be located in a remote cabinet or room within 140"-0" (42.6 m) wire feet of the elevator machine.

2.3 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.

B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.

C. Buffers, Car and Counterweight: Polyurethane buffer.

D. Hoistway Operating Devices:
   1. Emergency stop switch in the pit
   2. Terminal stopping switches.
   3. Emergency stop switch on the machine

E. Positioning System: System consisting of magnets and proximity switches.

F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.4 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway Entrances

1. Sills: extruded.
2. Doors: Hollow metal construction with vertical internal channel reinforcements.
3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.
4. Entrance Finish: Brushed Stainless Steel.
5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.5 EQUIPMENT: CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.

B. Platform: Platform shall be per manufacturers standard.

C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

D. Load weighing device shall be strain gauge type mounted to dead-end hitch attached atop the hoistway guide-rail.

E. Steel Cab
1. Panels: Non-removable vertical panels, plastic laminate selected from standard manufacturer's catalog of choices.
2. Car Front Finish: Brushed stainless steel.
3. Car Door Finish: Brushed stainless steel.
4. Ceiling:
   a. Round LED Down Light Drop Ceiling - LF-88: Satin Finished Stainless Steel three panel suspended ceiling with three holes per panel for Round LED lights.
5. Handrail:
   a. Custom Round - satin stainless steel - 2 in.. Rails to be located on Back Wall and Side Walls of car enclosure.
6. Flooring: By others. (Not to exceed 2sqft & 1/2" finished depth.)
7. Threshold: Aluminum
8. Protective pad hooks and quilted fire retardant protective pads: Pad to be hung from suspended ceiling

F. Emergency Car Signals
1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

G. Ventilation: Fan.

2.6 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation.

1. Full height car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have white illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be white Dot Matrix. All texts, when illuminated, shall be white. The full height car operating panel shall have a polycarbonate face plate that is shatterproof and impact resistant in a color and pattern per manufacturers standard selection.
2. Additional features of car operating panel shall include:
   a. Car Position Indicator within operating panel (white).
   b. Elevator Data Plate marked with elevator capacity and car number on car top.
   c. Help buttons with raised markings.
   d. In car stop switch per local code.
   e. Firefighter's hat.
   f. Firefighter's Phase II Key-switch.
   g. Call Cancel Button.
   h. Pre-programmed integrated ADA phone (complete description of krms features included as standard)
   i. Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
   j. Firefighter's Phase II emergency in-car operating instructions.

B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a polycarbonate face plate that is shatterproof and impact resistant in a color per manufacturers standard selection.
   1. Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture. Hall fixtures shall not be jamb-mounted. Hall lanterns shall feature white illumination.

C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down.

2.7 EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation
   1. Duplex Collective Operation (two cars): Using a microprocessor-based controller, the operation shall be automatic by means of the car and hall buttons. In the absence of system activity, one car can be made to park at the pre-selected main landing. The other car shall remain at the last landing served. Only one car shall respond to a hall call. If either car is removed from service, the other car shall immediately answer all hall calls, as well as its own car calls.
   2. Zoned Car Parking.
   3. Relative System Response Dispatching.

B. Standard Operating Features to include:
   1. Full Collective Operation
   2. Fan and Light Control.

3. Load Weighing Bypass.
4. Ascending Car Uncontrolled Movement Protection
5. Top of Car Inspection Station.
6. Zoned Car Parking.
7. Relative System Response Dispatching

C. Additional Operating Features to include:
1. Independent Service.
2. Hoistway Access Bottom Landing
3. Hoistway Access Top Landing
4. Provision for Card Reader in Car (Card Reader provided and Installed by others).

D. Elevator Control System for Inspections and Emergency
1. Provide devices within controller to run the elevator in inspection operation.
2. Provide devices on car top to run the elevator in inspection operation.

3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.
4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.
5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
7. Provide the means for the control to reset elevator earthquake operation.

2.8 EQUIPMENT: DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

B. Do not proceed with work until unsatisfactory conditions are corrected.

C. Prior to start of Work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

D. Prior to start of Work, verify projections greater then 2 inches (4 inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less then 75 degrees from horizontal.

E. Prior to start of Work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

F. Prior to start of Work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

G. Prior to start of Work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.

H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.2 PREPARATION

A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.3 INSTALLATION

A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

D. Lubricate operating system components in accordance with manufacturer recommendations.

E. Perform final adjustments, and necessary service prior to substantial completion.

3.4 CONSTRUCTION

A. Interface with Other Work:
   1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.
   2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.
      a. Ensure adequate support for entrance attachment points at all landings.
      b. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.
      c. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
      d. Coordinate interface of elevators and fire alarm system.
      e. Coordinate interface of dedicated telephone line.

3.5 TESTING AND INSPECTIONS

A. Perform recommended and required testing in accordance with authority having jurisdiction.

B. Obtain required permits and provide originals to Owner's Representative.

3.6 DEMONSTRATION

A. Prior to substantial completion, instruct Owner's Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION